World Petroleum

MARCH 1953

DRILLING AND EXPLORATION ISSUE

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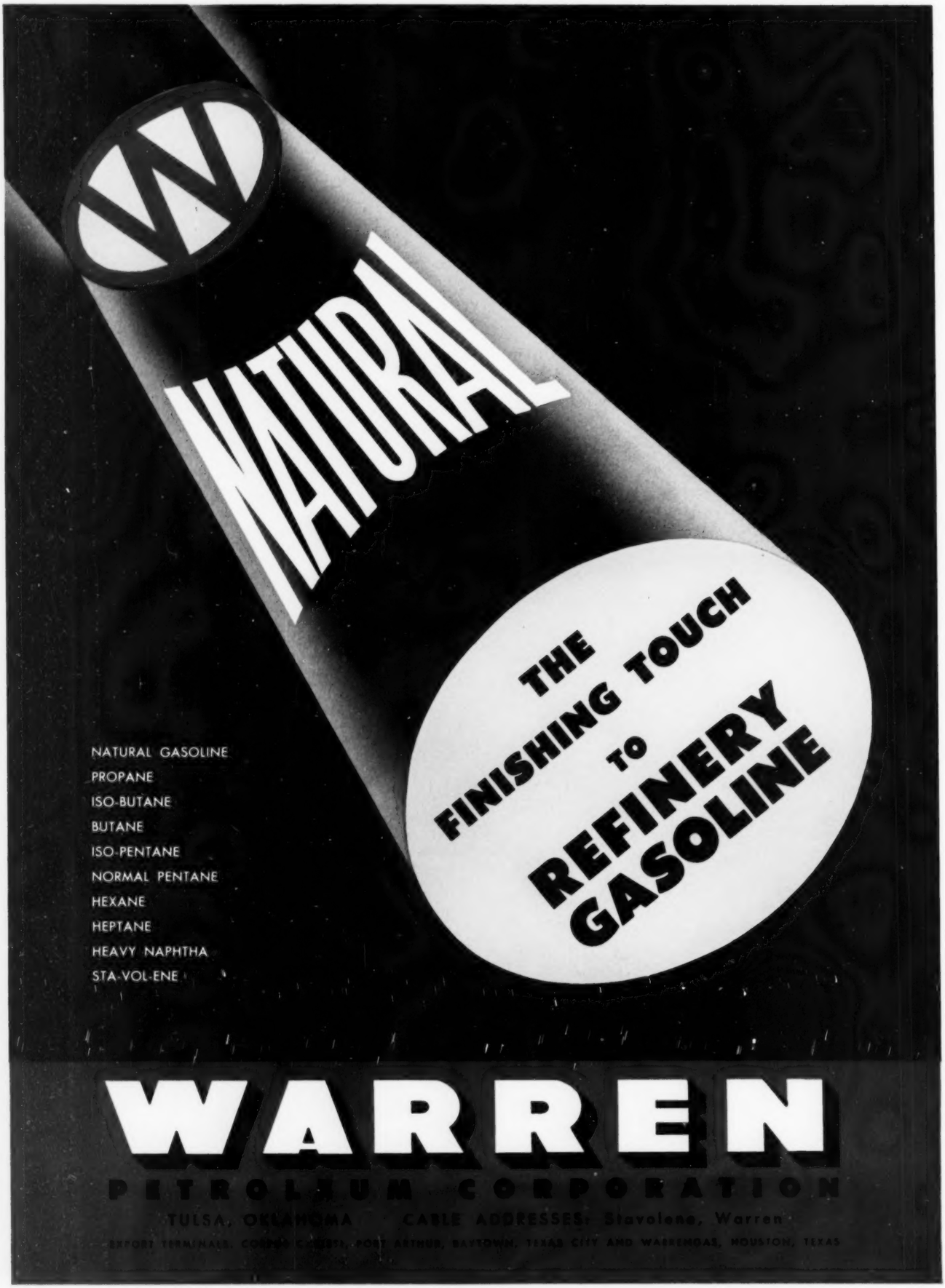
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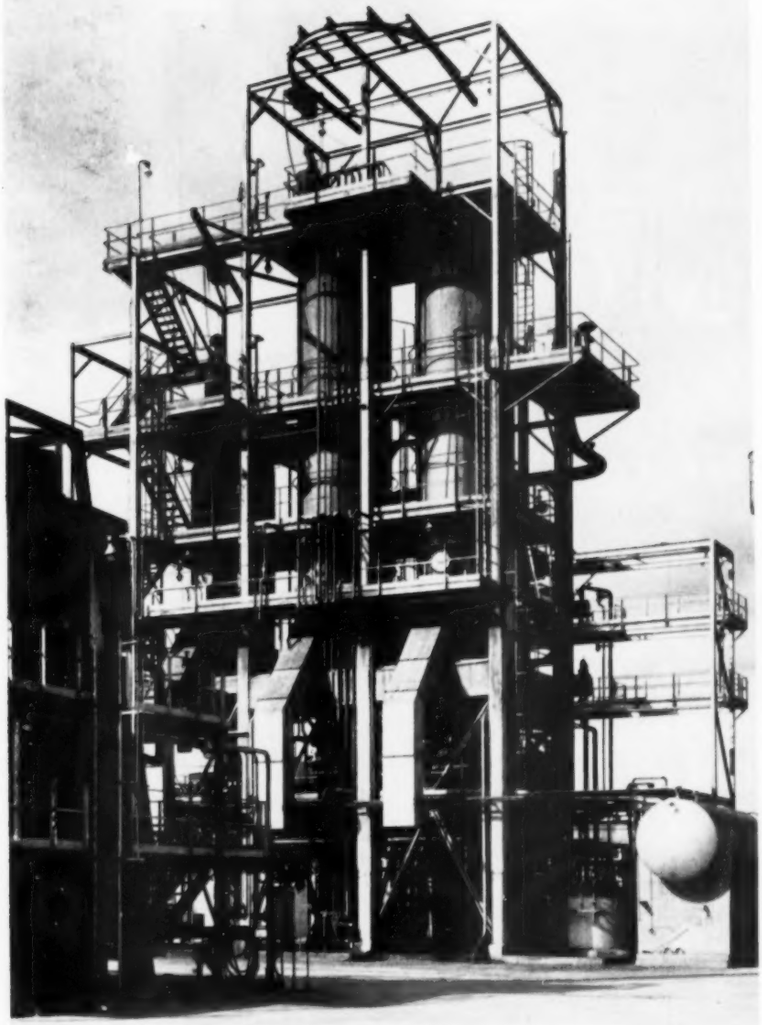
STAINLESS STEEL VESSELS

for Phosphoric Acid Plant in Scotland



View of the Grangemouth refinery Phosphoric Acid Plant showing the two reactors and the catch pot built by Chicago Bridge & Iron Company.

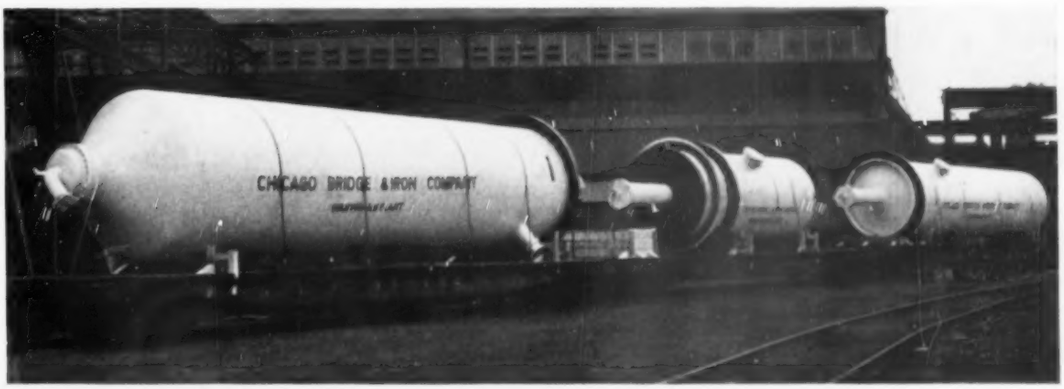
One of the most up-to-date petroleum refineries in the world is located on the Firth of Forth, midway between Edinburgh and Glasgow, Scotland. Previous to World War II, however, this Scottish Oils Limited refinery at Grangemouth had a capacity of 2.5 million bbls. per year. Completely remodeled since the war at a cost of about $42,000,000, it now has a crude charging capacity of 50,000 bbls. per day and produces motor gasolines, kerosene, gas-oil, fuel-oil, etc.

The illustrations at the left and below show two 9-ft. 3-in. diam. by 38-ft. phosphoric reactors and an 8-ft. 6-in. diam. by 22-ft. catch pot that we shipped to the Grangemouth refinery. These vessels are built of ASTM-A-240 Grade M, Type 316, modified stainless steel. The 30-in. flanged and dished heads on top of the reactors are made of A-285 Grade C, Firebox Steel and are lined with solid nickel. The dome head of the catch pot is made of the same steel but is not lined. Several other alloys were used for fittings and piping connections and a number of internal grid plates are made of solid nickel.

These vessels illustrate the type of structures we build for corrosion-resistant service. The handling of such a variety of alloys call for production experience, skilled personnel, and complete shop facilities.

Chicago Bridge & Iron Company also builds flat-bottom steel storage tanks, Hortonspheres, Hortonspheroids, Horton Floating Roofs, Hortondome Roofs and Vaporspheres as well as special steel plate structures. Write our nearest office for estimates or quotations. There is no obligation on your part.

Two 9-ft. 3-in. diam. by 38-ft. phosphoric reactors and one 8-ft. 6-in. diam. by 22-ft. catch pot ready to leave our Birmingham, Alabama, U.S.A., plant for the Scottish Oils Limited refinery at Grangemouth, Scotland.



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The New Louisiana Purchase

EVERY day America crosses a frontier—the frontier of a new market. It is the market created by an ever growing population. Since Pearl Harbor, our population has increased 23½ millions—more than all the people now living in the region west of the Mississippi once called the Louisiana purchase, that vast billion-acre area which provided us with geographical frontiers for a hundred years.

During 1952, 8,500 babies were born daily, increasing our population by nearly 3,000,000 people. New families and bigger families need more and bigger houses, more food, clothing, cars, roads, hospitals, churches, schools. Their needs call for continuing and increasing production from farms and factories.

There are those among us who say a decline in government spending will bring depression. But where is there room for depression when we add the population of another Minnesota or an Iowa to our nation each year—when the need for goods and services increases steadily? In fact, only by tapering off our vast programs of government spending can industry and business hope to provide sufficient goods to maintain our present standard of living and satisfy the demands of our ever growing population.

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New Factual Booklet—

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Read it—then judge for yourself which perforating service will get the results you want

Here's a completely new booklet prepared for production-minded oil men who are interested in getting more oil after perforating.

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... How simple, scientific design provides greater power and deeper penetration
... A series of penetration tests covering all sizes of McCullough Burrless Bullet Perforators

McCULLOUGH GLASS JET PERFORATING

... Types and sizes of guns
... Strip Carrier and Solid Bodied Guns
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SUMMARY, RESULTS IN THE FIELD, AND CONCLUSIONS

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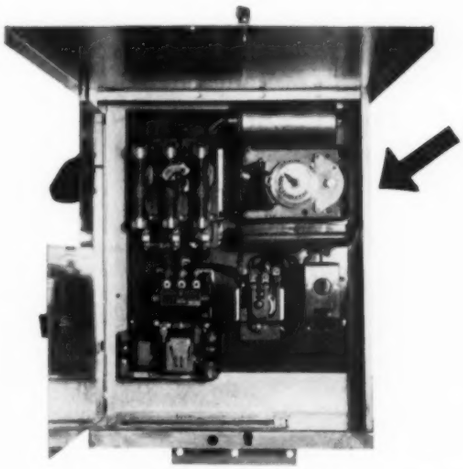

Better Motor Protection! New G-E oil-well pumping control (outer and inner doors open, timer cover removed) gives short-circuit, overload and undervoltage protection. Sequence timer and third overload relay can be added if desired.

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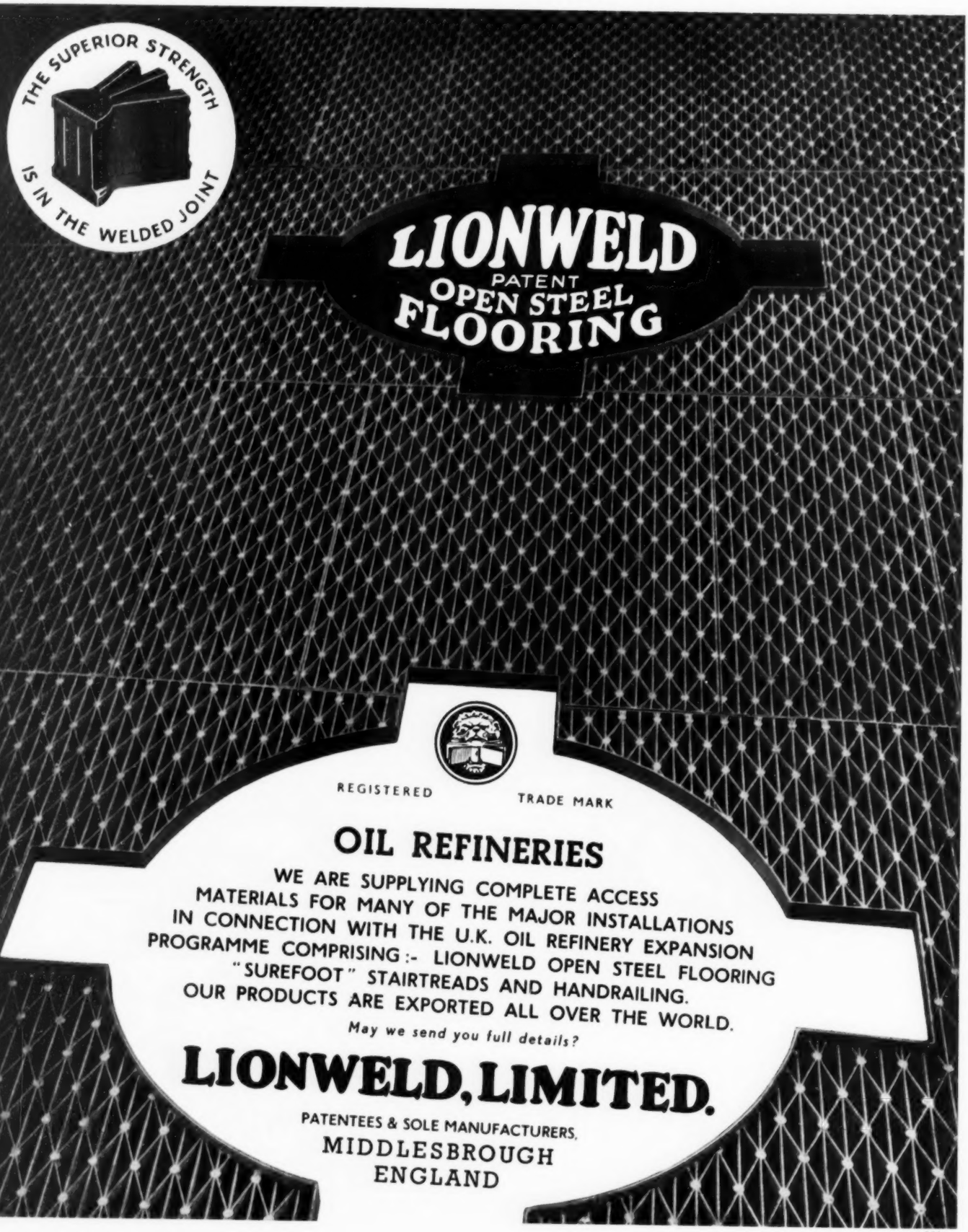
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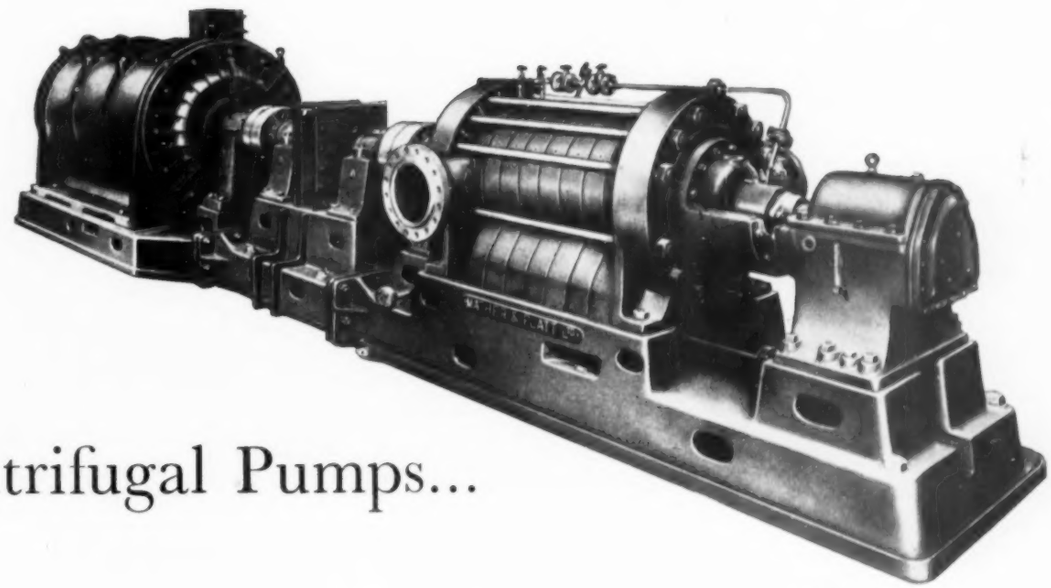
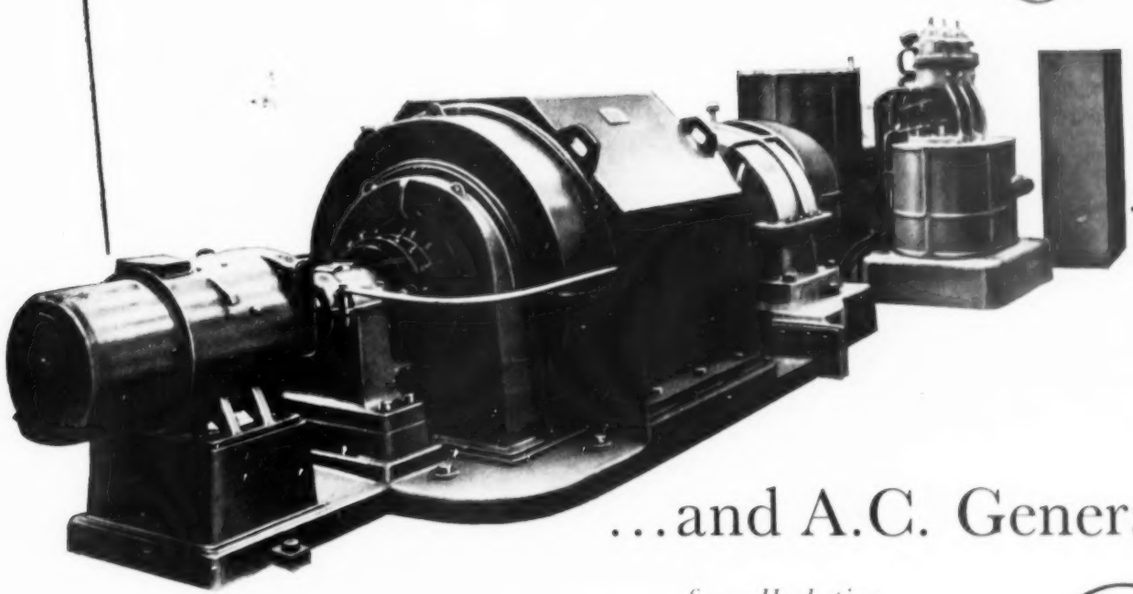
...Electric Motors



Centrifugal Pumps...



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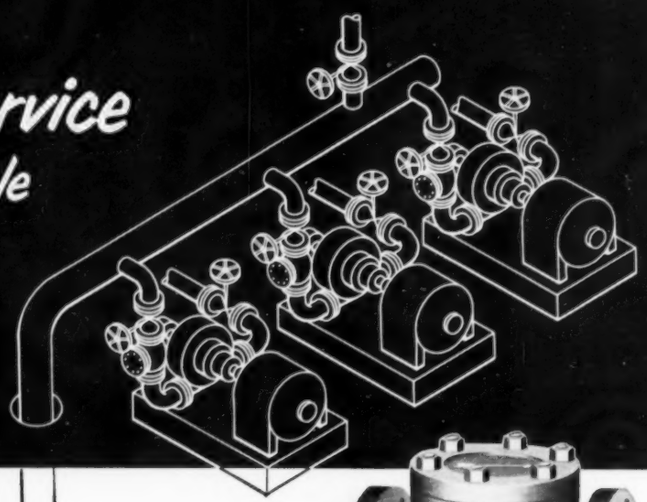
on Water Service
for example

(A Case History)



What you pay for valves is not the final criterion of value. Not when maintenance costs can quickly equal or exceed purchase price. And a valve that threatens production is no bargain at any price . . . no attraction to a thrifty buyer.

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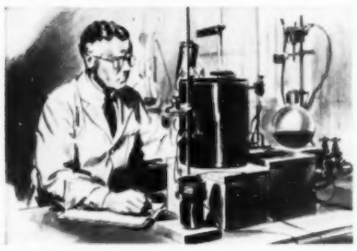

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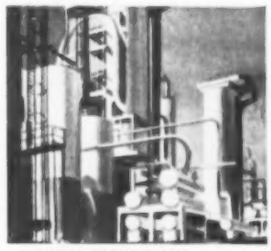

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THE PICTURES on this page depict the many vital operations necessary to produce and deliver the high-quality gasoline that modern car engines require. Exploration, drilling, refining, transportation, marketing—all these activities demand highly specialized skills, an army of workers. And these skills and workers must be fused into an efficient team if the price of gasoline is to remain low.

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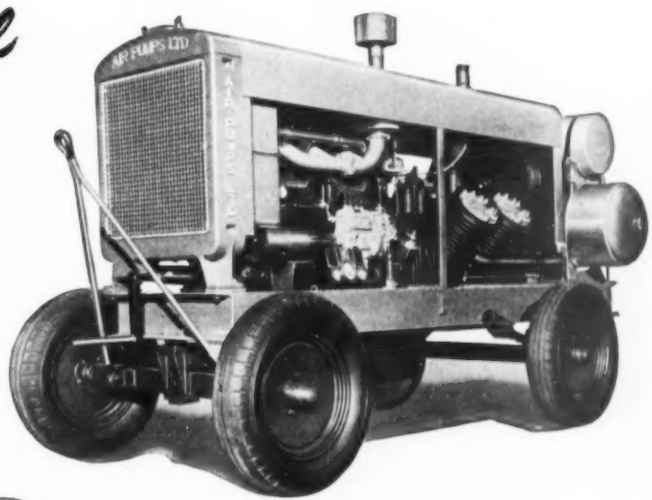

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IN relation to the vast array of plant and equipment which makes up the modern oil refinery, an assembly of gland packings is a small, almost insignificant component. But for all that, packings perform an important function, and we devote a very substantial proportion of our resources to the manufacture of those high-performance packings which are used at critical stages in refining processes.

Such packings, as every refinery engineer knows, are used in conditions of exceptional severity when they may simultaneously be subjected to high temperatures and pressures, severe chemical action, and to mechanical stresses and wear arising from contact with a rapidly rotating shaft. The performance of packings in these particularly arduous service conditions is governed by the degree of skill with which materials are selected and their physical properties brought into balanced combination within the basic form of a packing.

Foremost among the considerations which press upon a manufacturer of this particular class of packings, is the need to keep in step with continuing developments in the scale and techniques of refinery operations and to this end we have recently reinforced our facilities for research and development. Since 1949, we have equipped new laboratories, new test rooms and a new machine shop, and we have also established a much more effective system of control to ensure that uniform standards are maintained throughout the entire output of each style of packing. This, in our view, is a timely addition to our strength, which cannot fail to influence beneficially our ability to co-operate with refinery engineers on matters of mutual concern.

This is a spiral of CRANPAC Style 100 AL., a packing extensively used to seal the glands of pumps handling oils and petroleum distillates at high temperatures and pressures. The basic material used in the construction of this packing is a selected grade of aluminium foil which is tension-wrapped around an unlubricated core.

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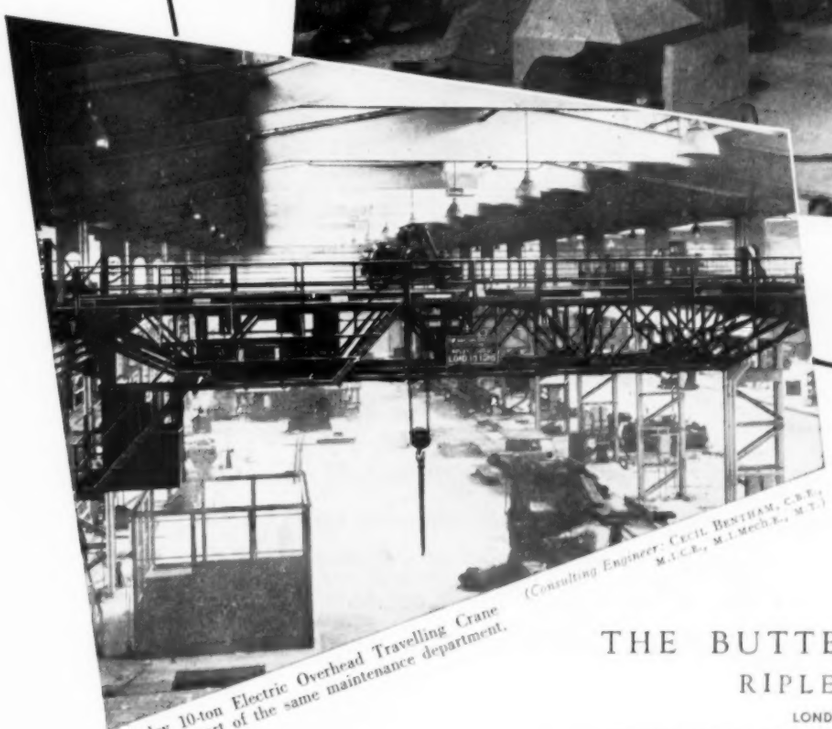
by BUTTERLEY

30 ton Butterley Electric Overhead Travelling Crane recently installed in the maintenance department of an important steel works.



Butterley 10-ton Electric Overhead Travelling Crane in another part of the same maintenance department.

(Consulting Engineer: CECIL BENTHAM, C.B.E., M.I.C.E., M.I.Mech.E., M.I.E.)

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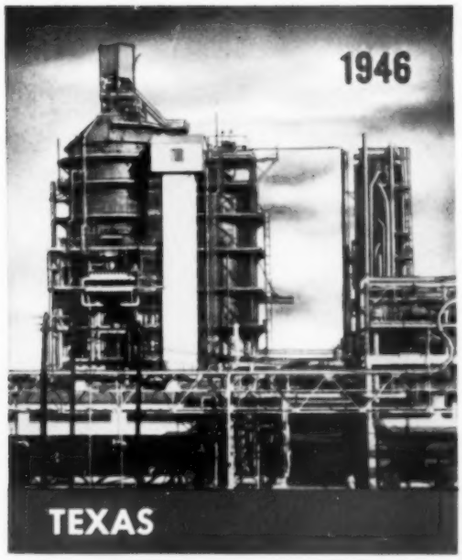

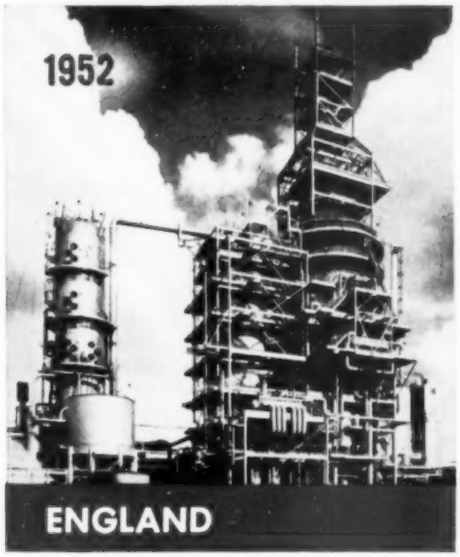

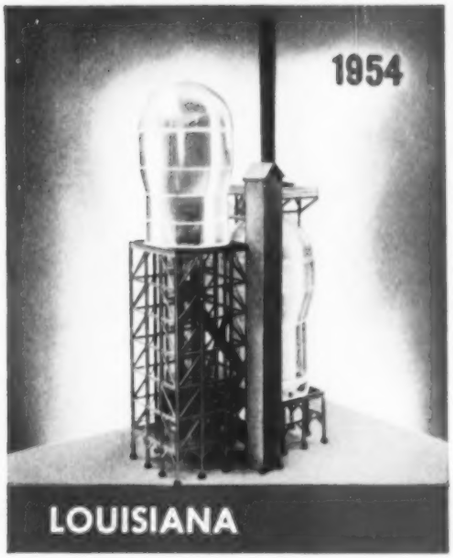

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FOSTER WHEELER CORPORATION
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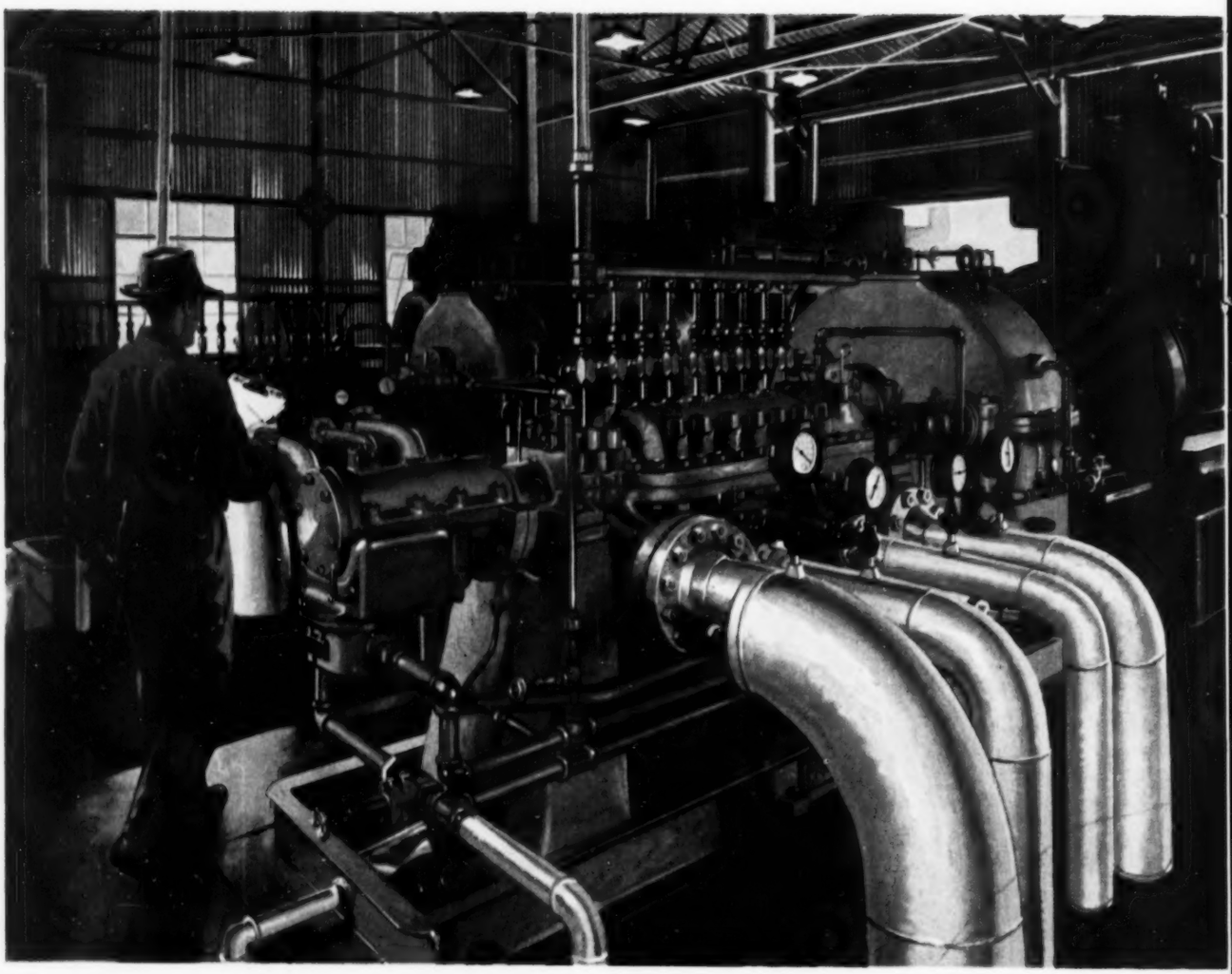

Pacific Pumps inc.

IS ONE OF THE DRESSER INDUSTRIES

Pacific Pumps Inc., of Huntington Park, California, has grown from a small group of six men in 1923 to one of the leading manufacturers of custom-built centrifugal and steam-turbo pumps in the United States. Pacific also licenses several manufacturers abroad. Superiority of design, engineering, quality and workmanship has elevated Pacific Pumps to a position of pre-eminence and leadership in the international petroleum and processing industries.

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Dresser Manufacturing Division, *Bradford, Pa.* Oil and gas and pipe couplings, fittings and sleeves—rolled and welded rings—welding fittings and flanges.

Kobe, Inc., Division, *Huntington Park, Calif.* Complete hydraulic oil field pumping systems, including the Kobe Free Pump.

No. 2 in a series about Dresser Industries

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Each member company is an individual specialist and leader in its field. The parent, Dresser, incorporates many added services into its over-all administration, yet each company retains its individual identity and management. Such an integrated organization derives economies that are passed on to the operator along with the many other advantages of the specialized experience, know-how, research and development of each of these operating companies.

Dresser Industries is a vigorous, competent, far-reaching team to help meet efficiently the world's ever expanding energy requirements—a service unlimited—that makes your job easier, faster, more productive. This is your dividend from these combined operations—the DRESSER PLUS+

In the Utility, Industrial, Marine Service and other industries where steam generating is required Pacific Custom-built Boiler Feed Centrifugal Pumps have long been accepted as the criterion. Pacific Pumps Inc., also operates an independent division (within the organization) exclusively devoted to the manufacture and sale of superior oil well plunger pumps.

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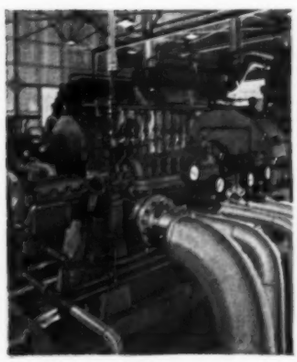
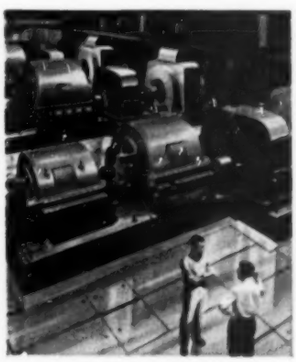
OIL, GAS AND CHEMICAL EQUIPMENT
ATLANTIC BUILDING ★ DALLAS, TEXAS



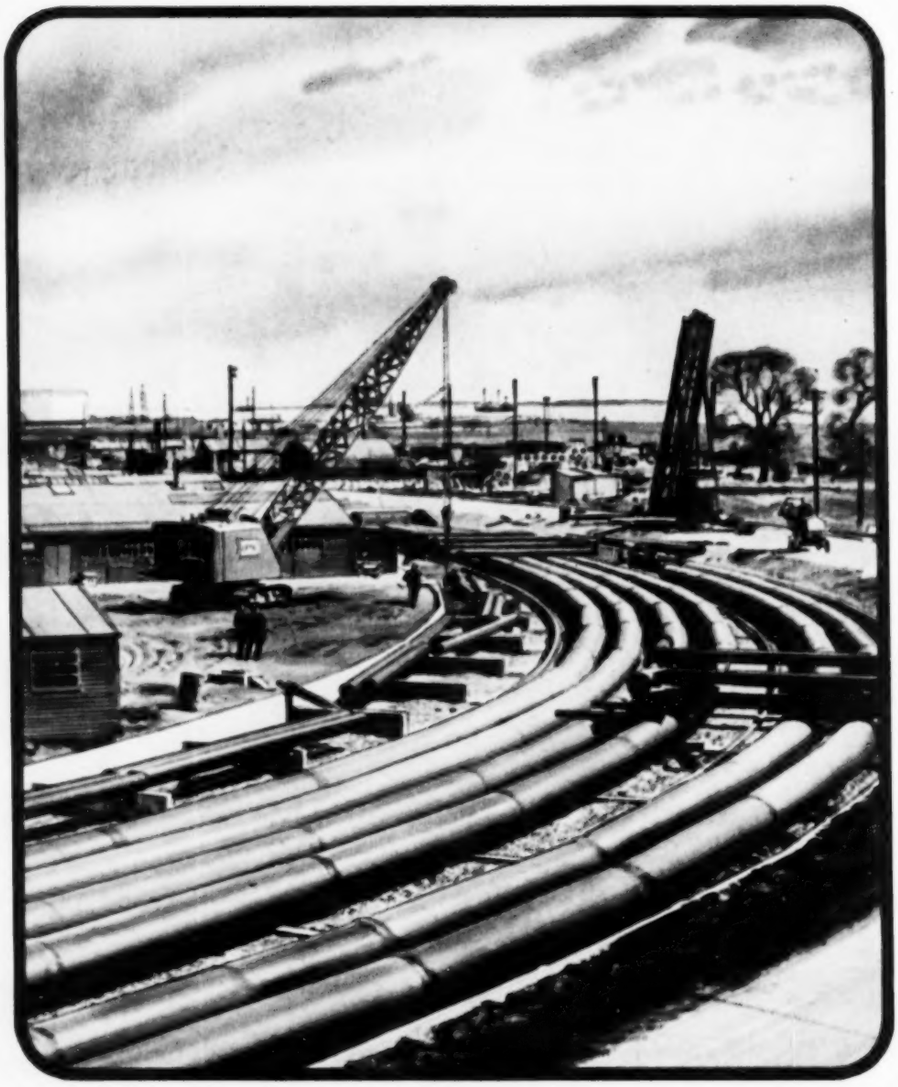
Pacific Pumps, Inc., *Huntington Park, Calif.* Centrifugal pumps, deep oilwell plunger pumps, hot oil and boiler feed pumps.



Roots-Connersville Blower Division, *Connersville, Ind.* Rotary positive blowers, gas pumps; centrifugal blowers, exhausters; positive displacement meters.

Security Engineering Division, *Whittier, Calif., Dallas, Tex.* Rock bits, reamers, casing scrapers, reamer rock bits, coring bits, Securaloy.

Ideco Division, *Dallas, Beaumont, Tex.* Derricks, drawworks, rambler drilling rigs, traveling blocks, rotary tables.



THE STEEL TUBE AGE

The major portion of the 500 miles of steel pipe required for the construction of the Coryton refinery has been supplied by S & L direct to site, in sizes ranging from ¼ inch to 43 inches diameter. In addition we carried out in our works the manipulation of some 2,000 tons of process pipework. We also supplied, direct to the refinery, welding fittings to the value of £30,000.

The illustration, based on a Vacuum Oil Company photograph, shows 36 inch S & L steel water-circulating mains, with externally welded steel joints, in course of being laid.

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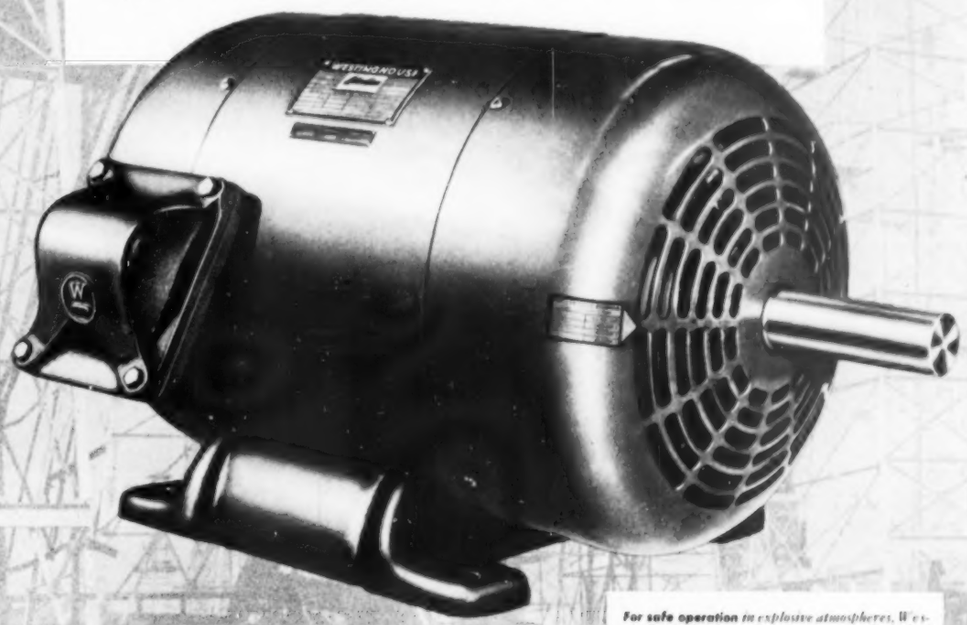
The motor that *smothers explosions!*

You can't stop a motor from throwing sparks . . . and if there's petroleum vapor around you can't prevent the ensuing explosion. But you can make sure such explosions cause no damage —by replacing outmoded motors with Westinghouse Explosion-Proof motors wherever petroleum fumes collect. These totally enclosed, fan-cooled motors smother explosions *inside* the motor, where they do no harm.

There's no secret about how this is accomplished. Closely machined fits are designed to keep any internal flame or spark from reaching the outside of the motor. That's why you can count on Westinghouse Explosion-Proof motors to deliver *safe* as well as *dependable* performance on pumps, compressors and other constant speed equipment in drilling, pumping, pipe line and refinery operations.

Add to this important safety feature the rugged, compact construction of Explosion-Proof motors—heavy steel or cast iron frame, feet and end brackets for maximum strength and rigidity . . . long resistance to corrosive atmospheres. Exclusive "Tuffernell" insulation and wire covering of synthetic resin provide high dielectric strength and long life. For more information about Explosion-Proof motors write to Dept. U, Westinghouse Electric International Co.



For safe operation *in explosive atmospheres, Westinghouse Explosion-Proof motors are furnished with characteristics suitable for a variety of applications. One to two hundred horsepower; 2 and 3 phase; 60, 50, 25 cycles; 208, 220, 380, 440 and 550 volts. Special voltages available on order.*

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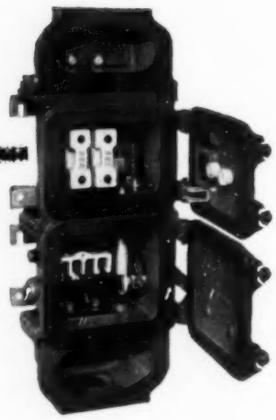
660 v. switch fuse unit with terminal box.



For controlling power and lighting circuits where flameproof gear is necessary in positions such as Mines, Petroleum Refineries and similar installations. The units have a maximum capacity of 100 amps. 660 v. and are readily adaptable to individual requirements, each component being housed in a separate cast iron flameproof enclosure. Approved for groups I, II and III gases by Buxton Certificates.

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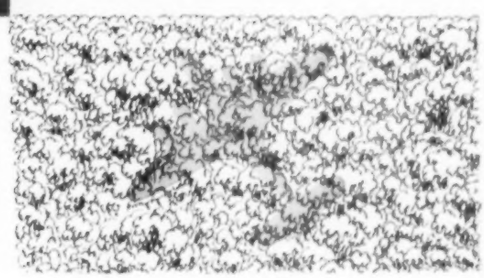
From Tokyo to Karachi; from the minerally rich highlands of Southern Africa to the coastal cities of Australia and New Zealand, the varied petroleum products of Standard-Vacuum weave in some way through the whole pattern of living.



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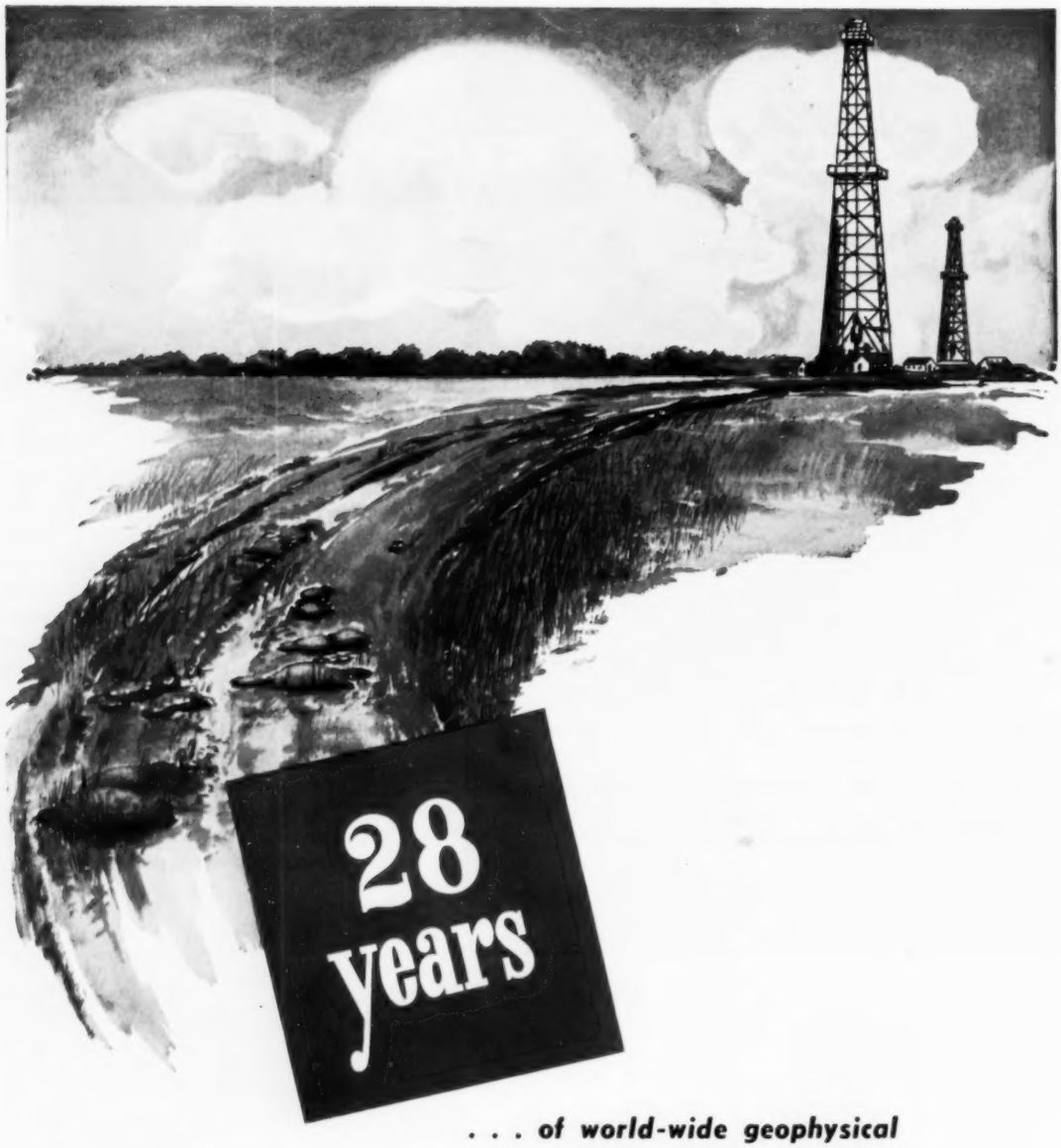

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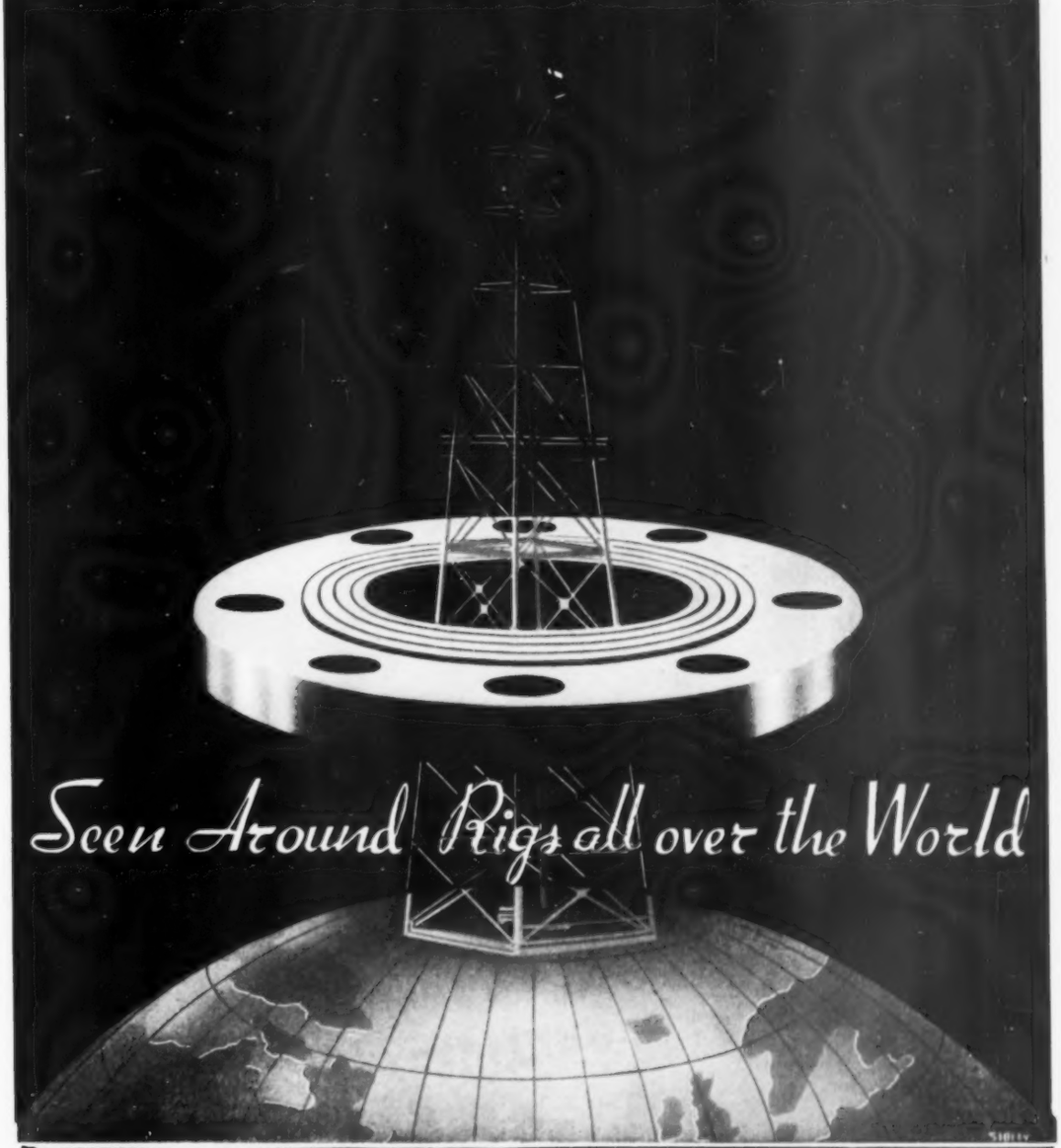

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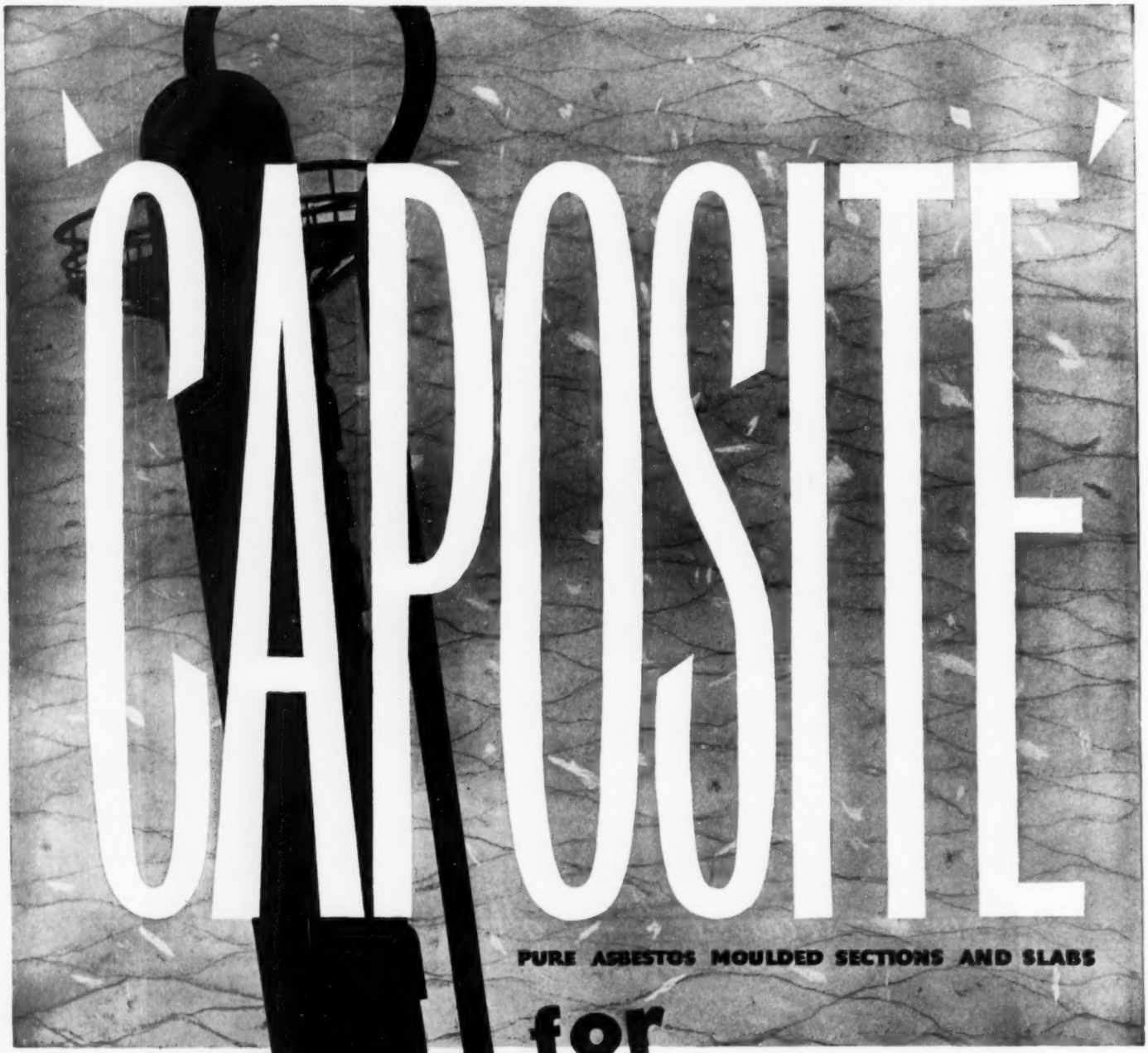

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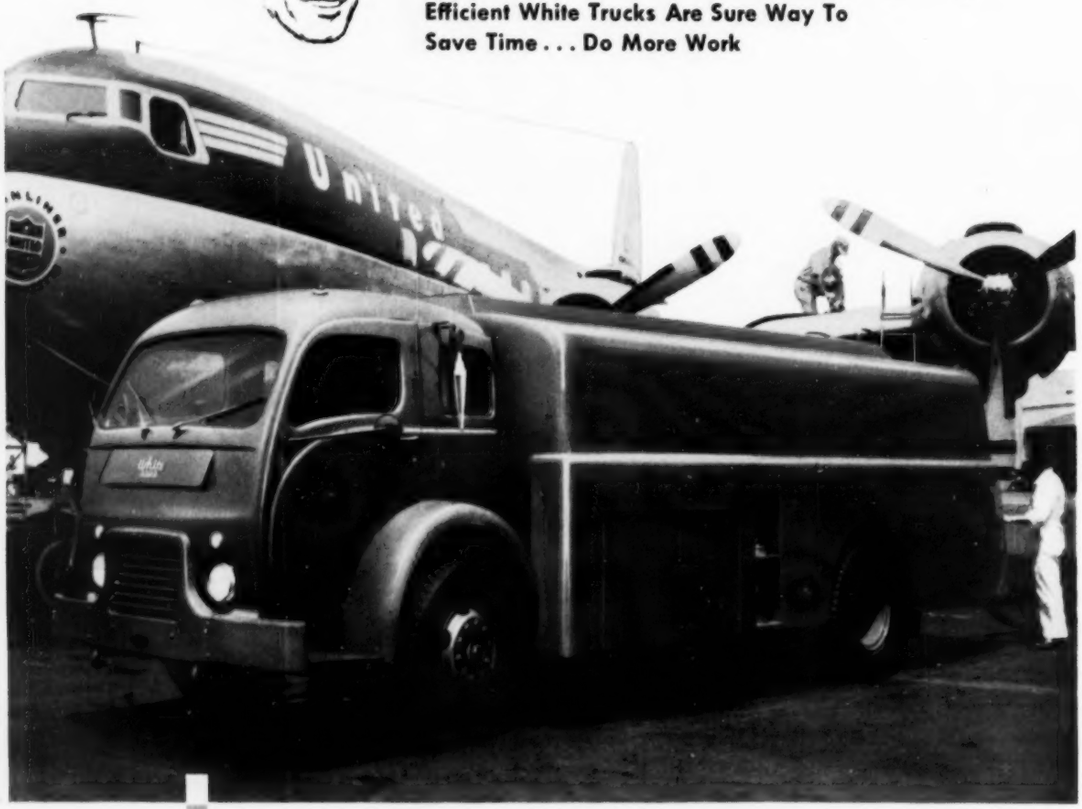

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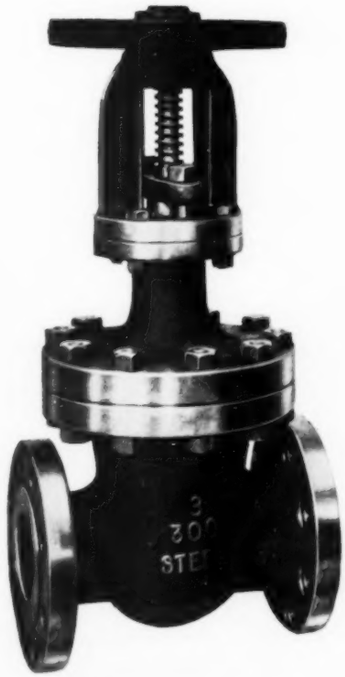

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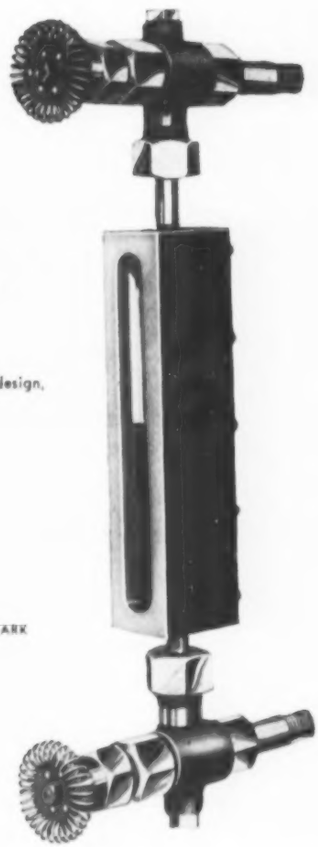

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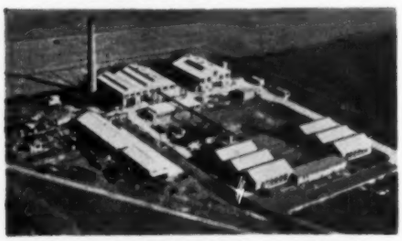

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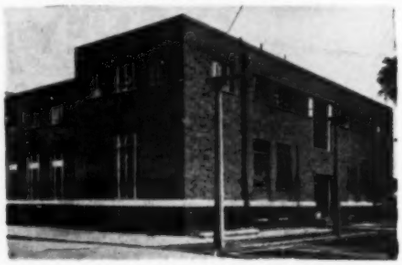

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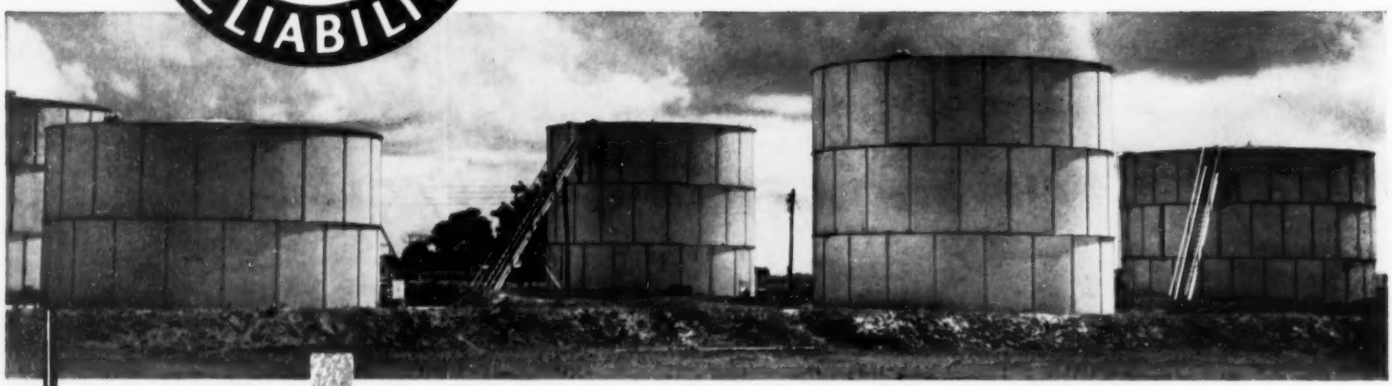

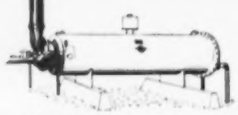

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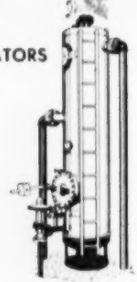
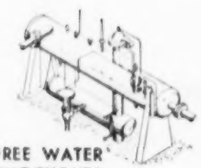
SEPARATORS





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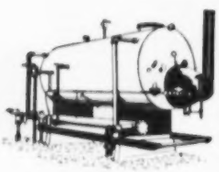

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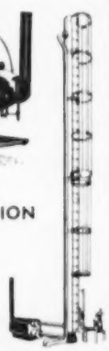

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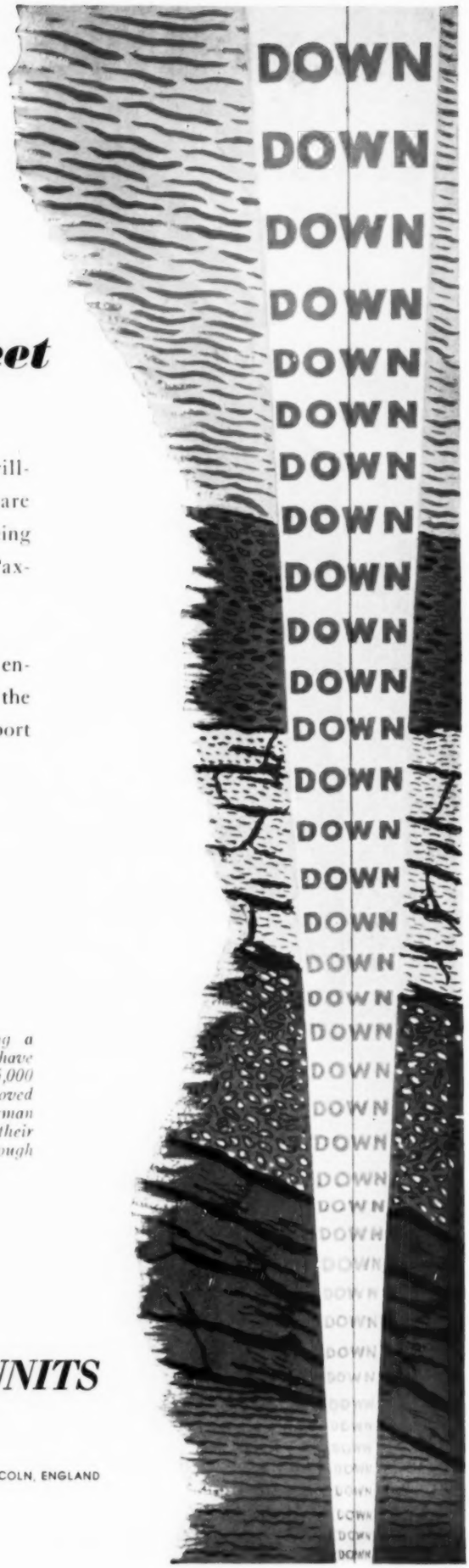
DOWN
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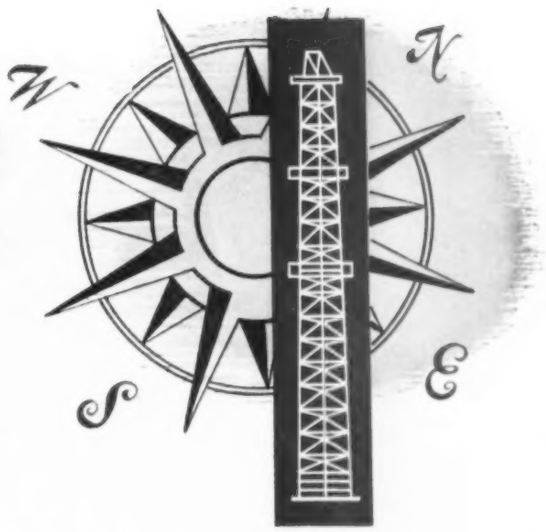
integrity

Avondale

service...

famous in the Oil Industry



A company is not only famous for what it does—but also for how it does it! AVONDALE has constructed, repaired, and fabricated for the Oil Industry for many years. AVONDALE barges, towboats, tugboats, drilling barges, personnel launches and offshore drilling platforms have made a name for themselves within the Oil Industry as being tops in Quality and Performance. But that's not all! AVONDALE'S satisfied customers within the Oil Industry, both large and small companies, are proof that AVONDALE integrity, the manner in which AVONDALE carries out a job to the letter, to the complete satisfaction of the customer, is something that has made customers return to AVONDALE time and again. Couple those two words, Integrity and Service, and you have the ultimate in what the Oil Industry needs and wants from a company rendering Service to them . . . . . .

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Oil Cargo Barge

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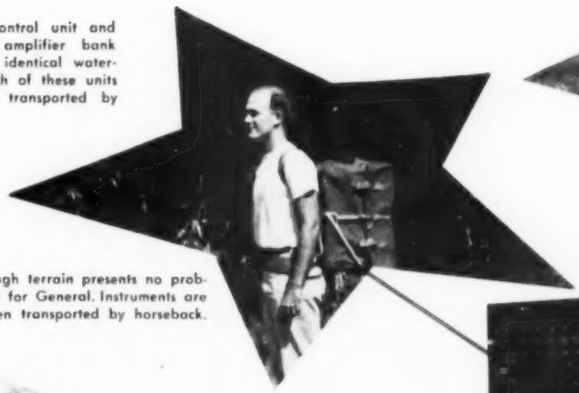
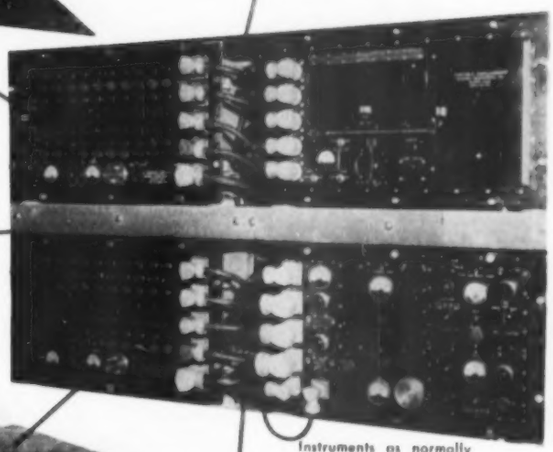
2 The Camera, control unit and each 12-trace amplifier bank are housed in identical watertight cases. Each of these units can be easily transported by one man.



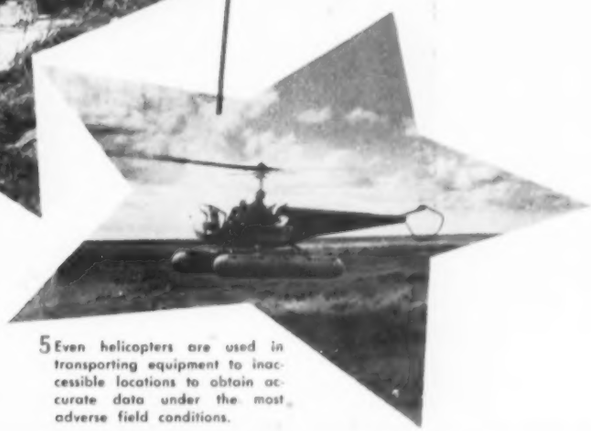
3 Rough terrain presents no problem for General. Instruments are often transported by horseback.



Instruments as normally installed in truck

4 In swamplands, General crews utilize air boats, marsh buggies, skiffs, weasels and other appropriate means of transportation.

General has the men, equipment and experience to help you explore deeper horizons. General's Dual-Purpose seismic units permit maximum portability without sacrificing General's high standards of efficiency in normal truck operations. These modern instruments, manned by experienced General crews, are your assurance of successful exploration programs.



5 Even helicopters are used in transporting equipment to inaccessible locations to obtain accurate data under the most adverse field conditions.

GULF BLDG. General GEOPHYSICAL COMPANY HOUSTON, TEXAS

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UNIVERSAL SERVICE PROTECTS
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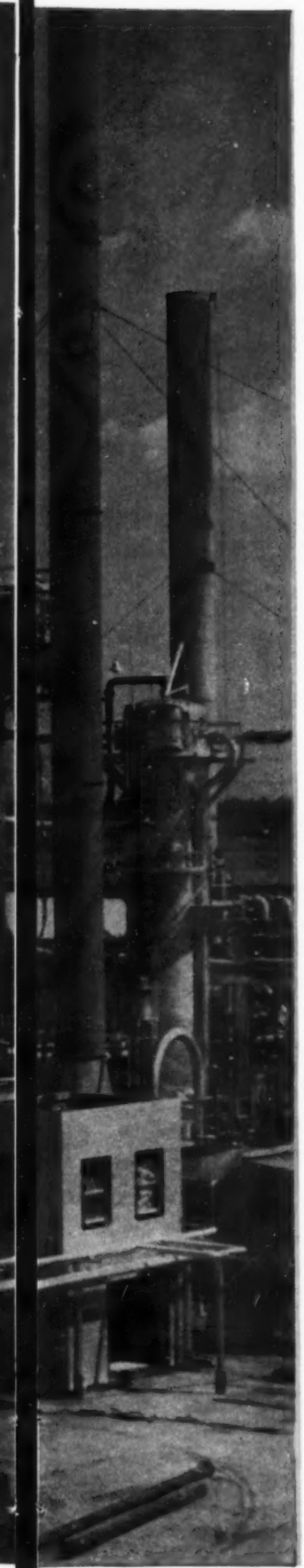

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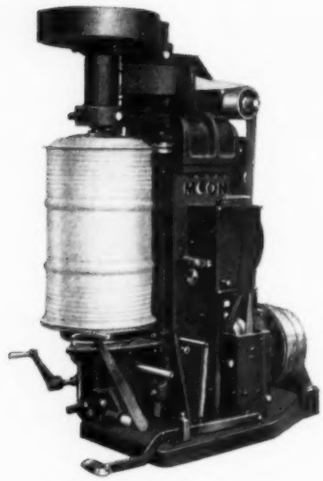

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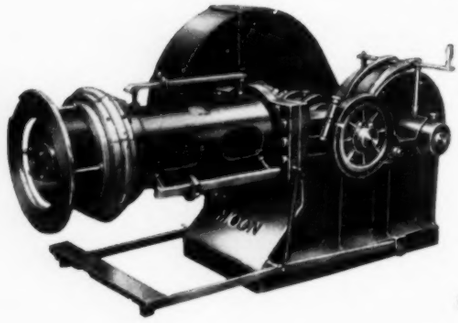

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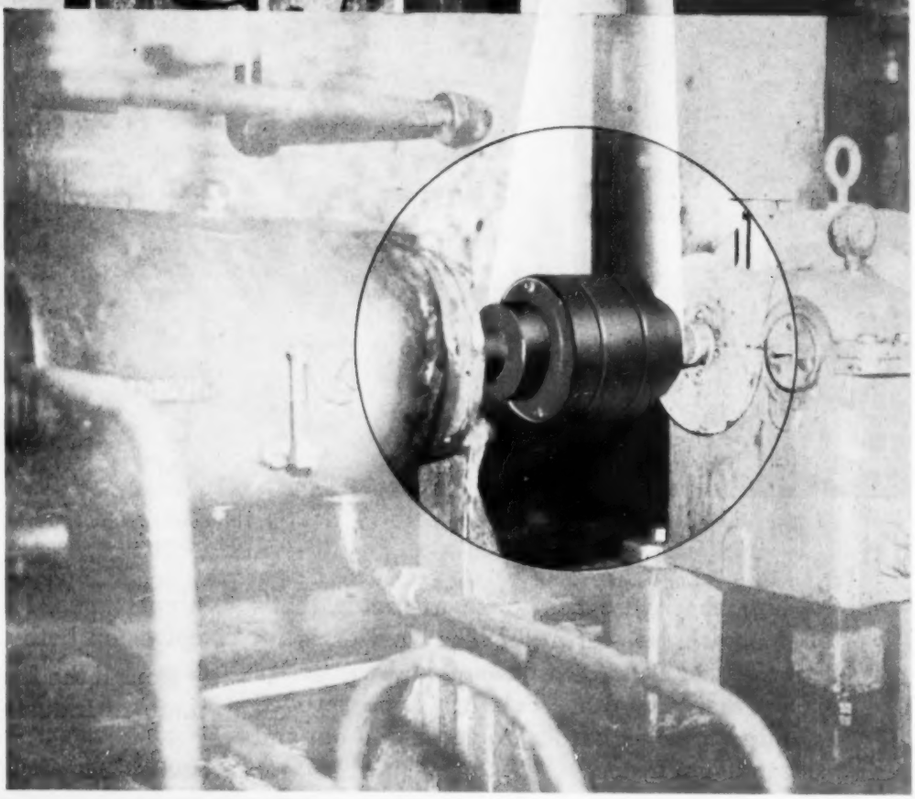

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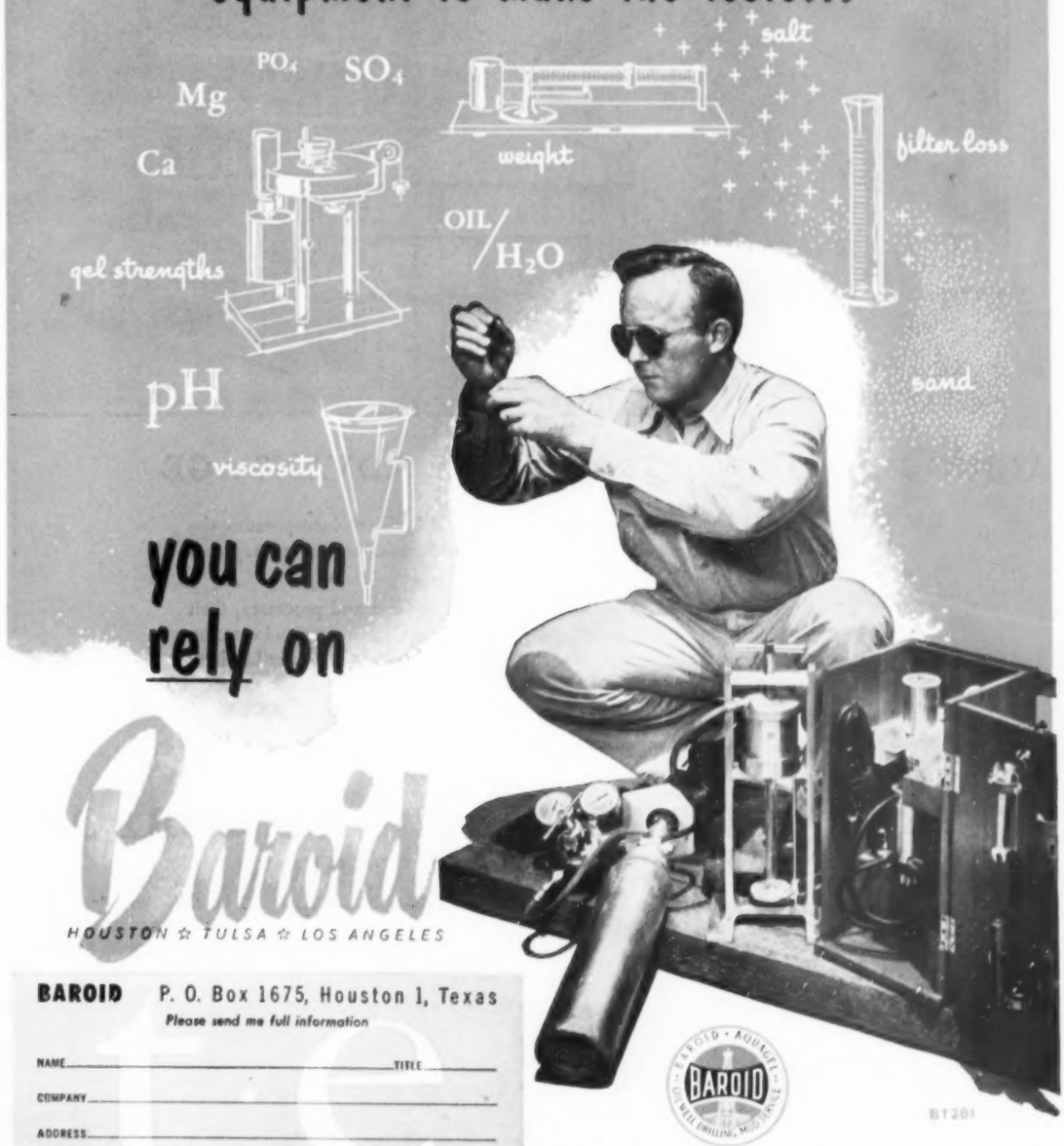

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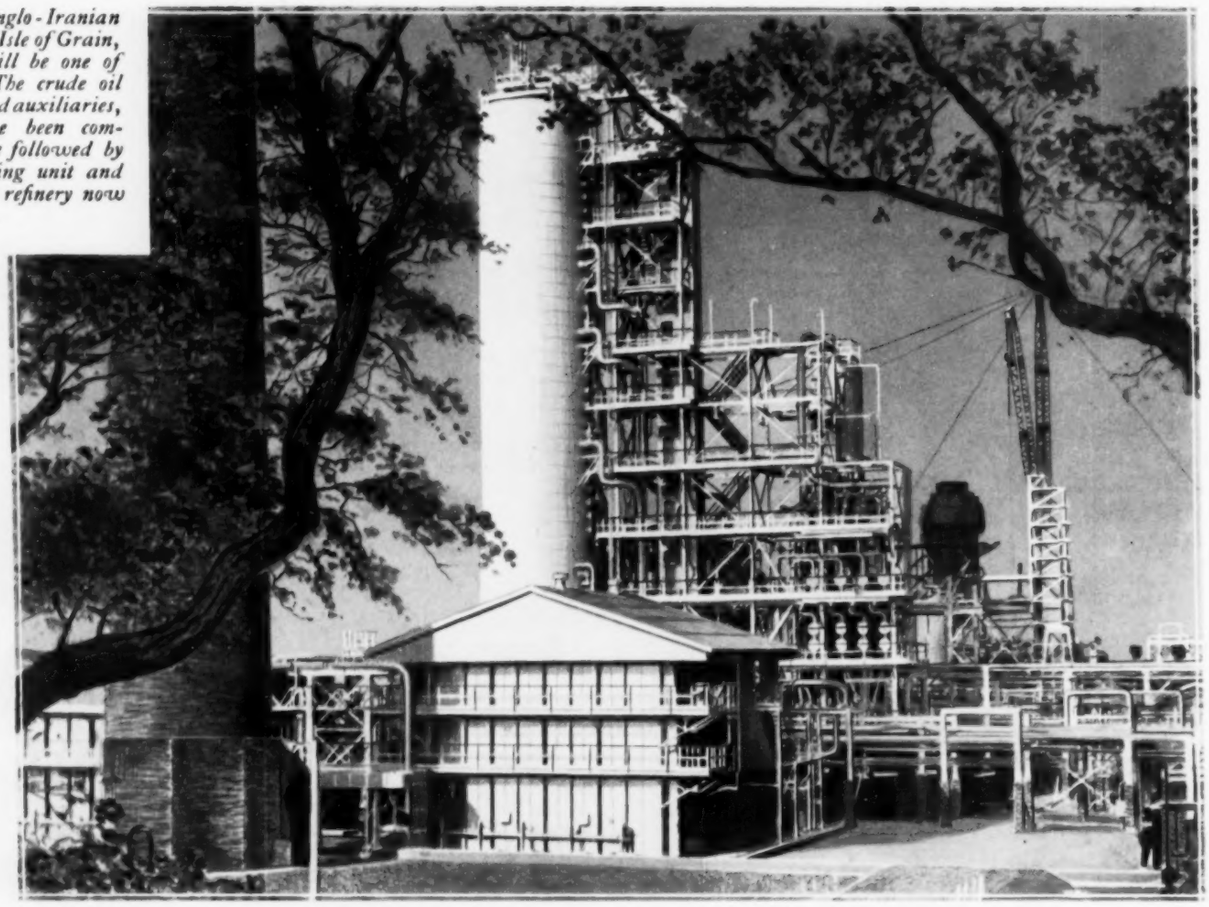
Kent Refinery of Anglo-Iranian Oil Company on the Isle of Grain, below London, will be one of Europe's largest. The crude oil distillation plant and auxiliaries, shown here, have been completed and will be followed by the catalytic cracking unit and the lubricating oil refinery now under construction.



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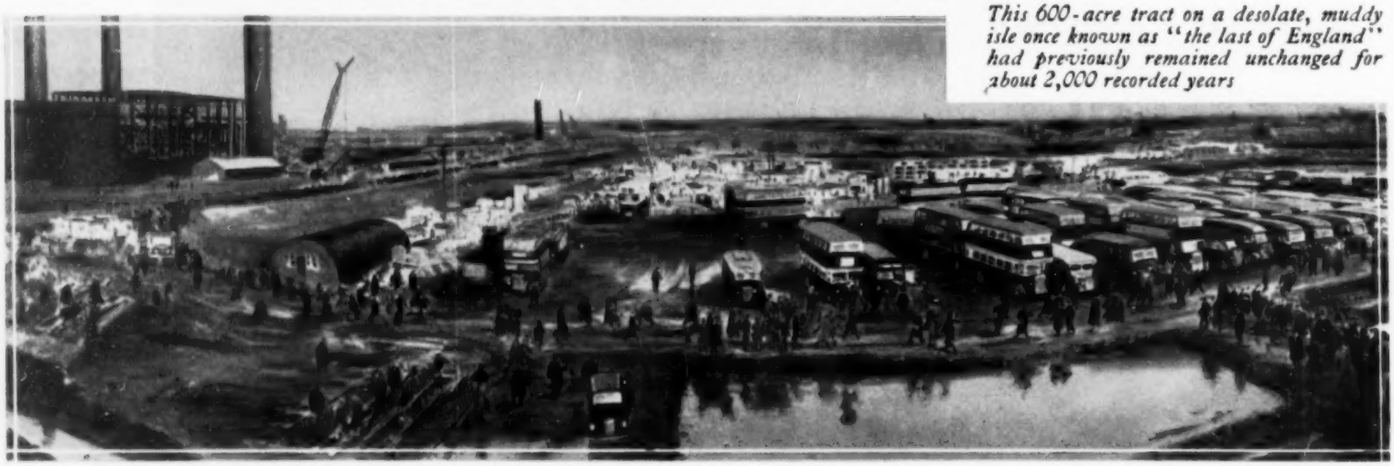

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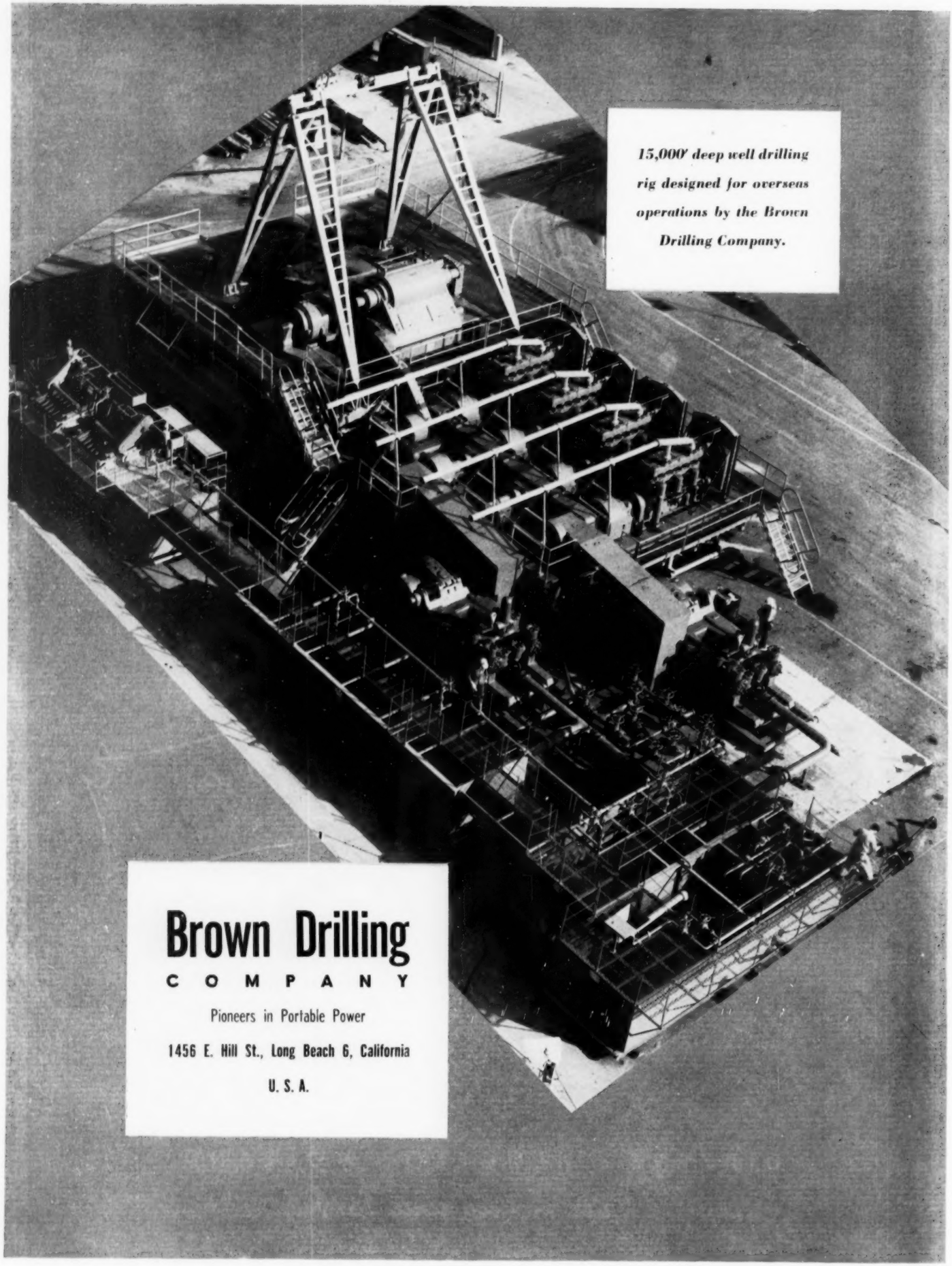
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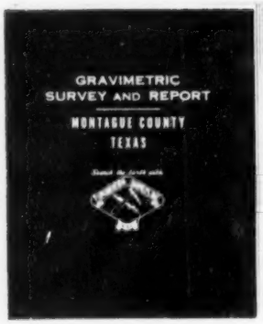

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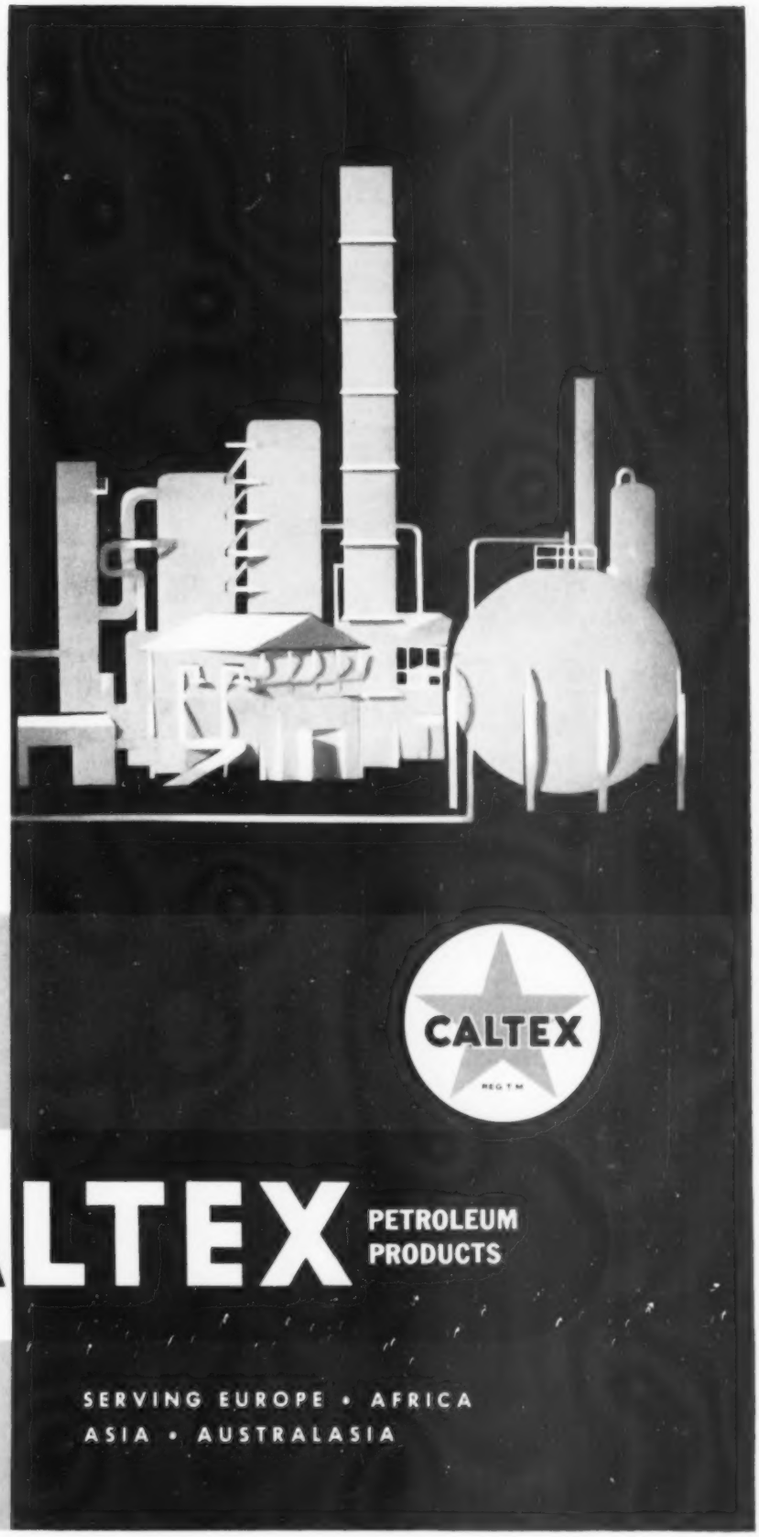

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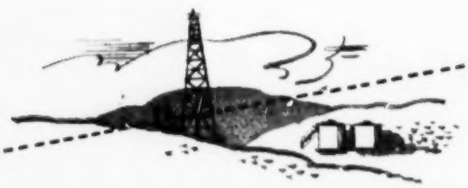

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A Shell Photograph

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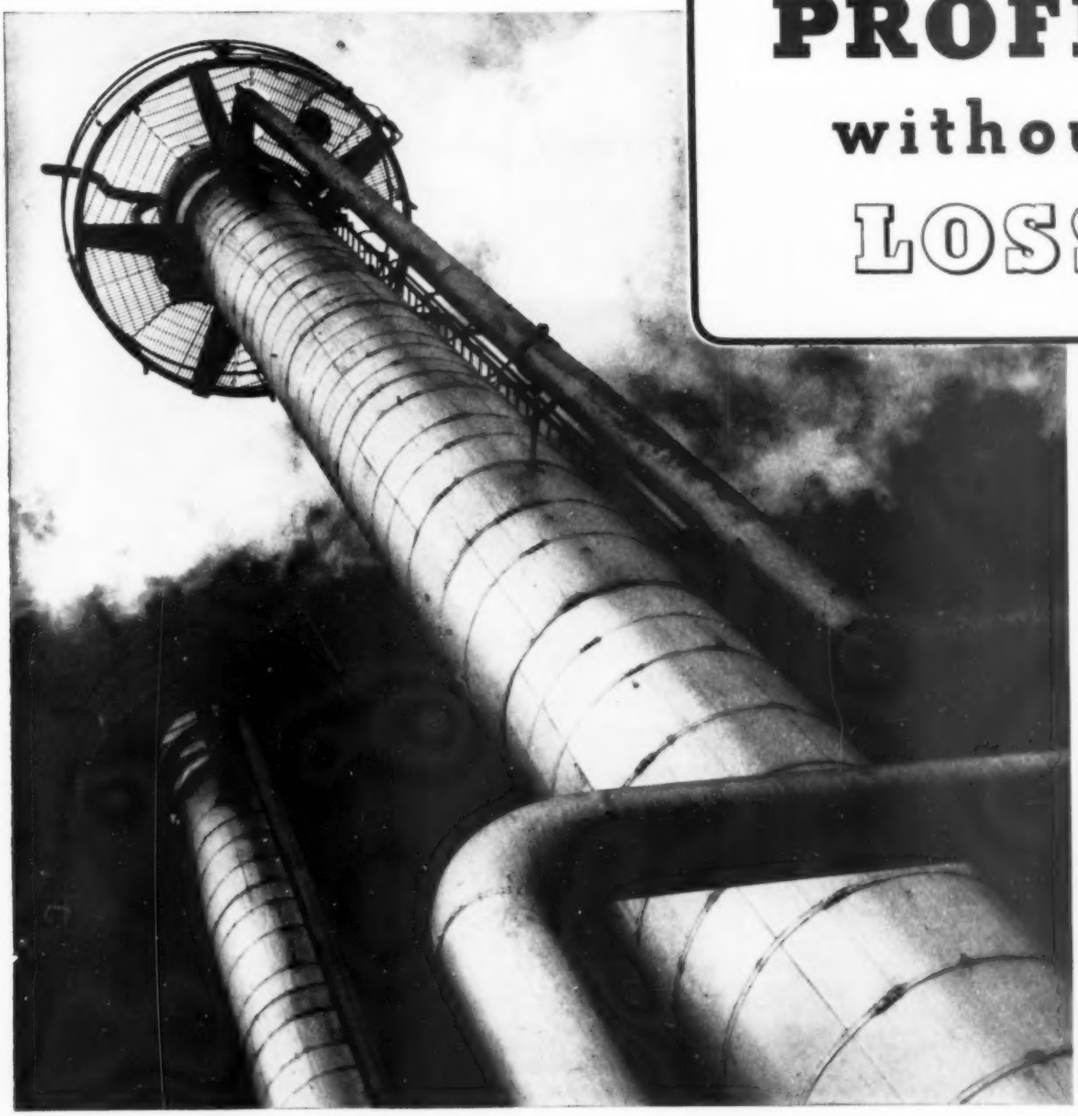

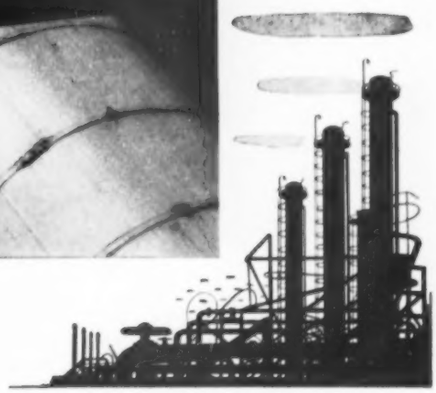

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From barren beach to busy refinery

Lummus writes a big engineering & construction story at DUNKIRK

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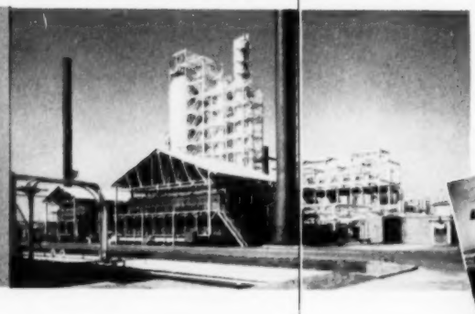

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THIS MONTH'S COVER

A new bit is poised over the rotary table of a wildcat well. Color photograph by Pat Coffey, Denver, Colo., for Standard Oil Co. of California. Color plates are reproduced through the courtesy of A. M. Johnson, editor of *The Bulletin*, quarterly house magazine of Standard of California.

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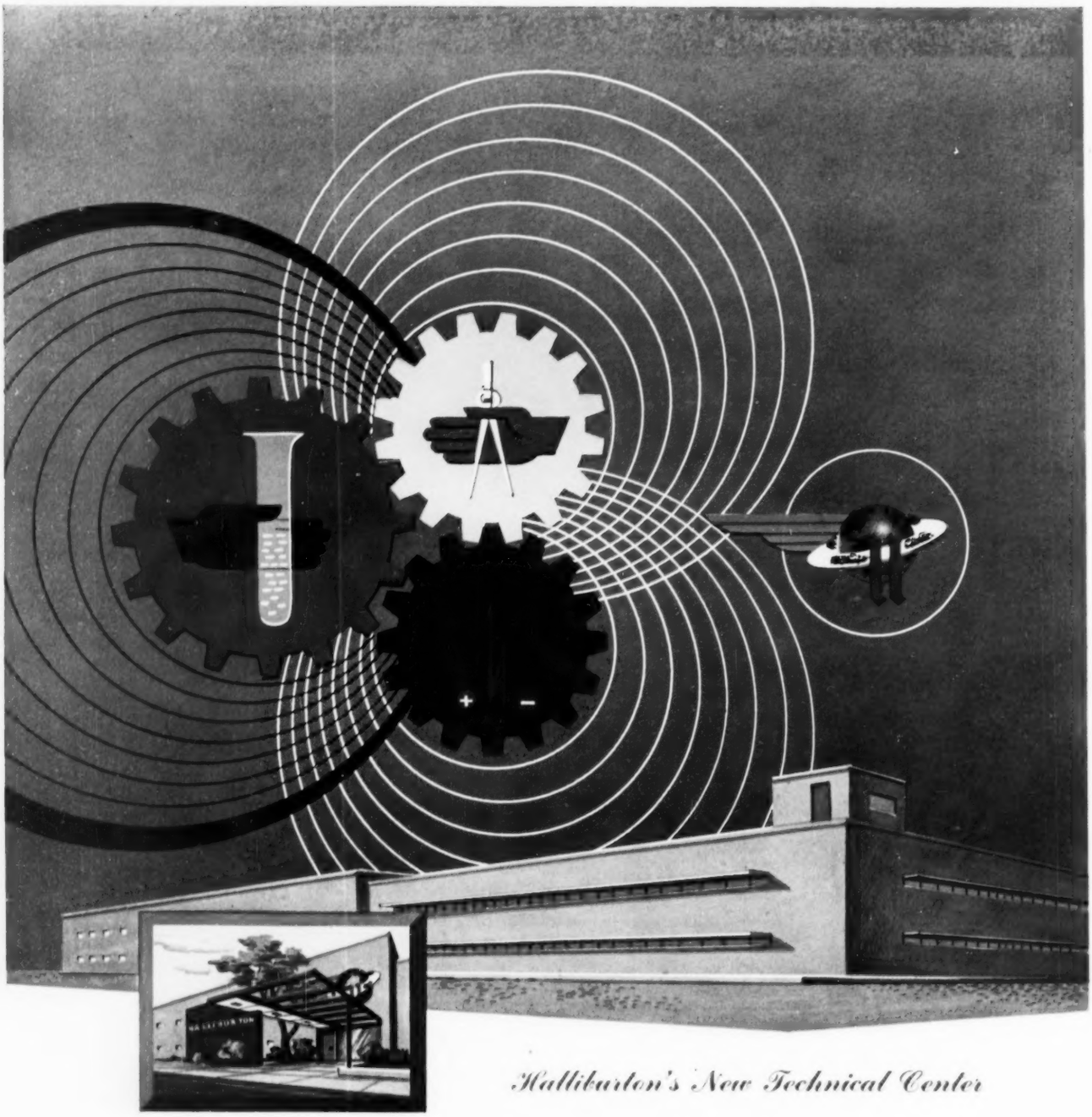

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OIL EXPLORATION IN A WORLD-WIDE ROLE

REMINISCENT of a much earlier day in oil history is the discussion that has been going on in certain quarters of the possibility that the swift expansion of the industry during the past dozen years has reached its apex and that from now on the growth of demand for its products will settle to a more sedate pace. It is pointed out that stocks of crude and products have risen to high levels, that consumption in the United States, the world's most voracious market, has risen at a slackening rate during the past several months, and that there are fewer drilling rigs and geophysical crews at work in such busy regions as Texas, Canada and Venezuela than was the case a year ago.

Time was, when the center of oil operations was located on Oil Creek in Western Pennsylvania, that the bringing in of a single large well or the opening of a promising new field sent prices reeling downward. Within a few years of Drake's epoch-making discovery, oil which had sold at 10 to 12 dollars a barrel had dropped to a dollar fifty, or less than the cost of moving it to market at the time.

Later on, when the industry had progressed to the point where it had more than a single product to offer, the opening of a series of great new fields in the Mid-Continent was followed in each instance by a market slump culminating when East Texas, greatest of all, was brought in during the worst depression of modern times and forced the price of oil in the field down to 15 cents a barrel.

In the past two decades, however, the industry has entered a stage of stability in which there has been no prolonged period when it has had a serious problem of oversupply to contend with. The demand for its products is broader and more firmly based than ever before. The principles of conservation in field operations are widely established. Broadly considered, the outlook points to a future growth to which as yet no limit can be set. It needs only a look around the world to show that the need and the desire for a wider use of oil is as strong as ever and that it is only lack of means or obstacles to trade raised by government restrictions that can put even a temporary brake upon expansion.

The underlying strength of the industry is confirmed by the survey on other pages of this issue which shows that the range of activity in exploration and in test drilling is greater than ever before. It is noteworthy that this is not confined to areas of present high production, but extends to countries which heretofore have had only slight or cursory attention from qualified technicians working with modern scientific equipment.

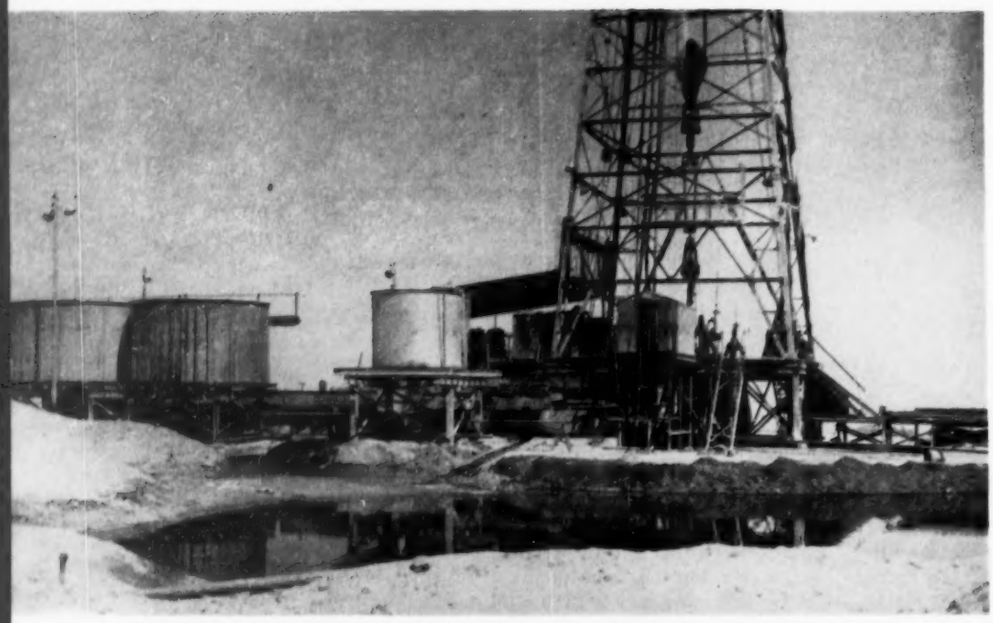
This development is a reflection of the realization by governments and individuals of the importance and value of oil as a fundamental factor in all industrial progress and as a contributor to economic well being.

An outstanding example of the broader interest prevailing in the study of petroleum resources is the current situation in Africa. Until the past few years, it had remained the Dark Continent so far as the search for oil was concerned. Now, by contrast, exploration is being extended to almost every part of its great area. Moreover, the current effort is being applied along the most up-to-date lines, including aerial reconnaissance, surface and subsurface geophysical surveys and the use of drilling rigs capable of testing much greater depths than the equipment formerly employed.

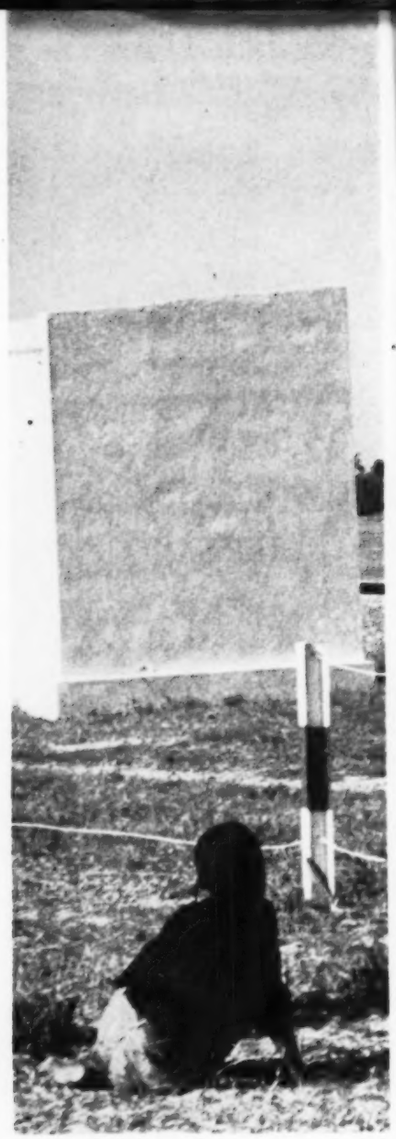
Renewed attention is being given to such countries as India, Pakistan and Australia and, in total, billions of dollars are being expended by international oil companies in a scientifically directed campaign to gain a better knowledge of the earth's resources of liquid energy.

From the viewpoint of the petroleum industry as a world unit, this is a highly encouraging development. Diversification of available sources of supply increases the importance of the world oil industry and every addition will lead to increased consumption, still pitifully small in many parts of the globe compared to the volume attained in the countries most advanced industrially.

The world, all parts of the world, needs more petroleum. As long as oil can serve mankind more effectively than any available substitute, its growth in size and influence will continue. Minor fluctuations will be no more significant than ripples on the surface of the sea and of no more effect upon the cosmic movements underneath.



Drilling rig in the Zubair field in Iraq. This field produced 16.8 million barrels in 1952, its first year of production.



World-wide search for oil embraces many new areas

NEVER BEFORE in the history of the petroleum industry has the hunt for new sources of oil supply assumed such intensity or become of such truly world-wide extent as it has attained today. For decades past, members of the hardy tribe of geologists have pushed their way to distant and difficult corners of the globe in their search for encouraging signs of hidden deposits and some of the most rewarding discoveries have been made beneath the most forbidding types of terrain.

Within the past several years, however, the tremendous growth in demand for the forms of energy that oil and gas can best supply, the realization that it is a fundamental factor in all industrial progress and the ambition of every nation to share in the benefits that come from the possession of indigenous oil have combined to intensify the search and to extend it to areas that previously had been untried or overlooked.

Most conspicuous as an example is the continent of Africa, which textbook authors once characterized as hopeless so far as any substantial petroleum possibilities were concerned. True, Egypt has long possessed some productive fields and for a number of years the French have persisted in efforts only modestly successful to find oil in the northern areas which they administer, but the remainder of this great land mass was overlooked or at least neglected. Now, by contrast, exploratory activity is being extended over practically the whole of Africa from the Mediterranean to the Cape of Good Hope. While the final effect of these efforts is still to be evaluated, failure at least will not be due to lack of endeavor or to neglect to employ the most advanced technical knowledge and equipment.

In addition to the work done by French companies in Morocco, where four fields have been located, Algeria and Tunisia where a number of tests have given encouraging showings, Gulf and Shell are participating in the further exploration of large areas in Tunisia. Gulf, operating in partnership with the government company SNAP, has completed aerial magnetometer and gravimeter mapping followed by a seismic survey and is drilling a wildcat, Ste. Juliette-1, which had reached 9,506 feet at the end of 1952. Shell also has been carrying on seismic work and has put down a well south of Sousse. Now the French have embarked on the ambitious plan of extending exploratory operations to the Sahara. A more detailed account of work done in Northern Africa appears in a separate article in this issue.

Further to the east, exploration in Egypt has been slowed down by onerous requirements of the nation's petroleum law, but a modification of its provisions undoubtedly would lead to renewed activity, particularly on the Sinai peninsula where some satisfactory producing wells were brought in earlier. In Ethiopia, Sinclair Oil Company is drilling its second deep test. Sinclair, in conjunction with the three American companies composing

Africa is being given intensive geophysical study in the search for oil. Plane shown is one engaged in surveying Portugese East Africa by Aero Service Corp. for Gulf interests.

the Conorada group, has made an agreement through Sinclair Somal Corporation to carry on exploration in the former Italian Somaliland in an area adjoining its Ethiopian operations.

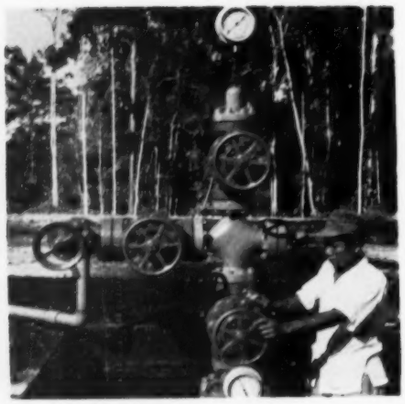
In Eastern Africa D'Arcy Exploration Company (subsidiary of Anglo-Iranian Oil Company) in conjunction with Royal Dutch/Shell has been carrying on an air photo reconnaisance of the coastal region of Tanganyika, including Mafia, Zanzibar, the Pamba and other offshore islands. Later this will be extended to parts of Kenya and will be followed by a comprehensive geological and geophysical program. In Nigeria, Shell and D'Arcy Exploration are carrying on a prospecting program. The first well drilled has been abandoned, but a second is being put down at Amansiodo and an Ideal 50 rig is being brought in for use on the third test. Surface exploration is also going on within the concession.

Under a concession held by Mozambique Gulf Oil Co., an aerial magnetometer survey of Mozambique has been followed by further geophysical work, and in October last the wildcat Doms-1 was spudded in and was drilling ahead at 6,789 feet at the year's end.

Other areas for which exploration is proposed are the Cameroons, Equatorial Africa, Portuguese West Africa, the Belgian Congo and the Gold Coast. In short, there is hardly any extensive section of the continent that will not be subjected to a more or less thorough scouting to determine its oil potentialities. A conspicuous discovery in any part of the area naturally would stimulate activity, but even without spectacular developments, a number of substantial fields should be uncovered.

In the Middle East exploratory activity has mainly followed a pattern of extending the development of concessionary holdings that are now producing in such volume as is required to meet demand. In Saudi Arabia, Aramco's program follows this line as is described in the article on the company's field operations which appears on other pages of this issue.

At Qatar on the Persian Gulf side of the Arabian peninsula, Petroleum Development (Qatar) Ltd. is drilling at Al Kharail, west of its established Dukhan field. Shell is preparing to start exploration of the offshore concession near Qatar which it acquired last year and has made similar arrangements for exploring the underwater area around the small island of Ayu Tibu. In 1952 Kuwait Oil Co. completed its Magwa-1 wildcat located some eight miles north of Burgan field and followed up this discovery with a step-out drilling program resulting in seven successful extension wells. Another successful wildcat was completed on the Ahmadi Ridge structure to the east of Burgan and Magwa as the year closed. In addition, 12 inside development wells were completed in Burgan field, bringing the total wells drilled to date in this important field to 131. Exploratory geophysical work continues. Production from



Christmas tree in the Minas field in central Sumatra which was opened to commercial production in 1952 by Caltex interests.

Kuwait for the year as a whole averaged close to 750,000 b/d. In the neutral zone between Kuwait and Saudi Arabia, American Independent Oil Company is conducting seismic surveys and starting its sixth test well which it plans to carry to the Jurassic level. In connection with the general program of expansion of the Iraq Petroleum Company, new fields have been developed both in the area operated by that company and in that of its associate, Basrah Petroleum Company.

At one other point in Iraq, test drilling is under way. This is in the field of operations of the Khanaquin Oil Company, the last remaining holding of the Anglo-Iranian Oil Company in this part of the Middle East. A well was spudded in at Chia Surkh late in 1952 and has reached a depth of over 3,000 feet. It is being sunk in an effort to reach the deep reservoir believed to underlie the field. It was here that William Knox D'Arcy first drilled for oil in Persia in 1902-1905, the site of the first well being recorded by a commemorative plaque.

Another well was started in mid-February at Naft Khanah where a field already exists, part of it lying in Iran and part in Iraq. The field at present is being produced on both sides. On the Iran side there is a small topping plant, while the oil produced on the Iraq side is refined at the El Awand refinery of the Khanaquin Oil Company.

Further east in Pakistan and India, considerable exploratory work is being undertaken, but in Burma progress is stalled by unsettled conditions, although new wells have been drilled in Chauk. In Baluchistan a 10,000-foot well was drilled without finding oil, but it did locate a gas-bearing limestone in the Eocene. A second well is being sunk in a nearby area in the hope of finding more extensive gas deposits.

The Burmah Oil Company has been active in exploratory work in Pakistan and India. In western Pakistan a well drilled on the Balkhassar structure has been plugged at 7,700 feet to test the Sekesar limestone which gave a small production of heavy oil. Acid treatment is needed before the caliber of the well can be established.

Attock Oil Company Ltd., through its subsidiary, Pakistan Oilfields Ltd., is drilling in two areas in West Pakistan at Bains, where the first well had to be abandoned at 3,939 feet due to mechanical difficulties and where the second well has reached a depth of 2,075 feet. The objective is the Eocene limestones which lie deep.

A test bore is also being drilled at Dhariala and has reached a depth of 4,159 feet. Heavy flows of saline water have been encountered and attempts are now being made to seal off this water and permit deepening to continue to ascertain if oil bearing rocks occur below the salt. The discovery of oil in the Lower Eocene in 1951 is being exploited by the deepening of wells in the Dhulian field. Indications are that the new horizon is at least equal in extent to the old main horizon.

In eastern Pakistan, Patharia No. 3 in the Sylhet district was abandoned early in 1952, but a second well was about 1,200 feet down at the end of the year. Some structure drilling near the town of Sylhet was completed in October. A gravity survey, amplifying previous reconnaissance work, was in progress in the last few months of the year. Further south, near Chittagong, drilling was begun on the Patiya anticline in April and the well had reached 7,000 feet by the end of the year without finding oil-sands.

In India, attention has been given to the alluvial areas near the Digboi field where geophysicists of the Compagnie Generale de Geophysique conducted an electrical resistivity survey to obtain evidence of the eastward trend of the structure beneath the alluvium, and so assist in guiding the choice of sites for the deep exploratory drilling which has been in progress there for some time. The Digboi wells produce from the Miocene Tipam sandstones on the upthrow side of the Naga thrust-fault, and attempts have been made to explore the beds on the downthrow side. These have led to drilling at Nahorkatiya, southwest of Digboi, where a well located on a seismic survey in the alluvium on the northwest side of the Naga thrust had reached over 7,000 feet by the end of the year and was drilling in the Tipam sandstone.

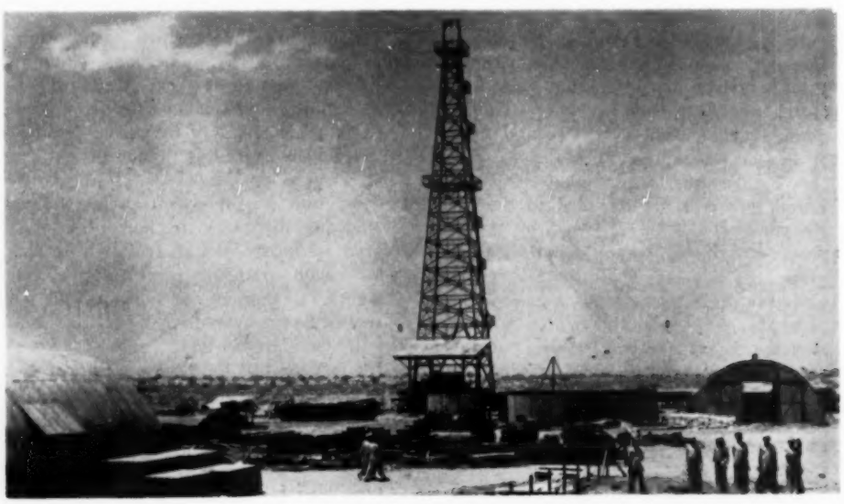
Some 140 miles farther southwest, a test well at Nichuguard was completed at 4,655 feet without finding production, and by the end of the year a second well, located on another part of the Nichuguard structure, had just begun drilling.

Geophysical surveys have been made for Assam Oil Company in an area of over 8,000 square miles in the Brahmaputra valley. Tests have been drilled near Tinsukia and Nichuguard.

In the Pacific area the rising demand for petroleum has encouraged new efforts to expand production. Shell has two rigs operating in Sarawak. A new test is shortly to be spudded in and surface exploration is being continued. Exploration work is being done outside the limits of the Seria field in Brunei. A test is being drilled at Rasua and preparations have been made for putting down additional wells elsewhere in the territory. Exploration work including test drilling is scheduled for Borneo, South Sumatra and the Vogelkop area of New Guinea during 1953.

An important development in Indonesia during 1952 was the start of shipments from the Minas field of Caltex Pacific Petroleum Mij. in Central Sumatra. Pre-

A deep test in Pakistan which is being made the scene of an exploration program to develop indigenous oil supplies for the young nation.



liminary work in this area was begun before World War II and was resumed after its conclusion. Drilling was started in 1949 and shipments have now reached 20,000 b/d. Exploration work is being extended and a number of wildcats have been drilled during the past year.

Exploration in Papua has been going on for a number of years and is being continued by Standard Vacuum Oil Company and D'Arcy Exploration who are partners in the Australasian Petroleum Company and Island Exploration Company. Geophysical crews have been active in the delta regions around the Gulf of Papua and survey parties have been working inland. A test well at Omati was complicated by a fishing job which was satisfactorily accomplished, enabling drilling to be resumed. At last report, it had reached a depth of 12,000 feet.

A renewed attempt to uncover substantial petroleum deposits in Australia is under way. This time attention is being directed to Western Australia which several prominent geologists have pronounced the most likely source of oil in the island continent. Western Australian Petroleum Pty. Ltd., organized by California Texas Oil Company and AMPOL, holds a concession to explore 350,000 square miles of mostly desert country. Seismic surveys have been carried on during the past year. Selection of a site for the first test will be made this year.

Detailed accounts of exploration and drilling activity in France and Germany are given in articles appearing elsewhere in this issue. A third European country in which a vigorous search for oil and gas is being pushed is Italy. Development of gas reserves in the Po Valley is proceeding steadily and while the government has reserved this area for Italian nationals, several international companies are engaging in exploratory work in other parts of the country.

In Sicily, under a grant from the regional government, Anglo-Iranian Oil Co. is conducting an extensive surface reconnaisance while gravity and seismic teams are also at work. The American International Fuel and Petroleum Co. (Gulf) has been carrying out a structure drilling program on its Ragusa concession and is continuing its work preparatory to a deep drill test.

On the mainland, a number of exploratory programs are projected, including one by ANIC in which Esso Standard has a joint interest.

In neighboring Yugoslavia, increased drilling is being undertaken in an effort to provide more oil for domestic use. Another newcomer to the ranks of exploration is Switzerland where D'Arcy Exploracion de Gaz et Petrole S.A. has been conducting geological surveys in Fribourg and neighboring cantons in collaboration with Societe des Etudes des Interets Minieres. A deep test also is projected near Luzern by Itag Internationale Tiefbohr A.G. in conjunction with a group of Swiss capitalists.

Several desultory attempts to find oil in Spain have been made, but these for the most part have been confined to shallow drilling, the only tests of any substantial depth having been wells of about 7,500 feet, one at Lerida and the other in the province of Soria, both of which were abandoned as dry holes. Now CEPSA, the Spanish national company, is preparing a more comprehensive test of the Aran valley based on the possibility that strata which have been found productive on the French side of the Pyrenees may extend beyond the mountains and that either oil or gas may be found.

Plans for further exploration in Holland may be held in abeyance by recent damaging floods, but in Denmark, the Danish American Prospecting Co. (Gulf), after abandoning temporarily its first deep test in South Jutland, is drilling Tonder-2 which had reached 10,155 feet at the end of December. Seismic work is continuing and four stratigraphic tests have been completed.

From behind the Iron Curtain come reports of large increases in production from established fields. As usual, these are unaccompanied by details, but it is generally accepted that the Soviet Union is making a concerted effort to add to its petroleum resources.

The search for oil in the United Kingdom continues despite the lack of substantial success achieved thus far.

Plans are afoot to drill for oil in the Widnes area of Lancashire where oil shows were found recently in the course of drilling operations undertaken by the National Coal Board at a depth of 1,650 feet. This is only one of a number of indications of oil occurring in Lancashire. At Formby, some hundreds of tons of oil have already been produced by drilling to a depth of only about 100 feet. This oil is believed to have seeped from larger deposits as yet unlocated. Several boreholes have already been sunk in an endeavor to discover the source of Formby's oil and another is projected at Ainsdale, near Southport. At Croxteth, Lancashire, where Steel Bros. & Co., Ltd. hold drilling licenses covering an extensive area, a well is planned to test geological evidence of the existence of oil. A test is being drilled at Whitby, Yorkshire, in an endeavor to determine whether natural gas, already known to exist in the area, is present in commercial volume.

Apart from actual drilling, geophysical and geological surveying of a number of areas has been undertaken. One such survey, at Screveton, a few miles south of Eakring, Nottinghamshire, has just been completed and the results are at present being studied.

Anglo-Iranian Oil Company, working through its subsidiary, D'Arcy Exploration Company, is continuing its exploration in the south of England. On a site found by gravity survey and confirmed by seismic reflection survey, an exploratory well was spudded in at Perreton Farm, Arreton, in the center of the Isle of Wight in October last, which by the end of the year had reached a depth of 2,256 feet and will be drilled to 8,000 if necessary.

The company has been interested in the possibility of the presence of oil in the southern districts for many years in view of exposures of oil sands and occasional seepages along the coast. Deep tests have been drilled at Portsdown Hill, overlooking Portsmouth Harbor, close to a large deposit of Kimmeridge oil-bearing shale, at Henfield in Sussex, at Kingsclose, near Newbury, Posell and Chaldon Down in Dorset, but none led to any discovery.

Chauk field in upper Burma where older wells are being deepened as part of the effort to rebuild the industry to pre-war proportions.

Deep offshore Pedernales wildcat currently being drilled in Venezuela coastal waters by Creole Petroleum Corp. Creole photo.

Western Hemisphere drilling continues at high level

DRILLING AND EXPLORATION was active in every petroliferous area in the Western Hemisphere in 1952 and gives promise of continuing at a satisfactory rate again this year. The level probably will be somewhat above 1952 and will set the customary new record. The petroleum Administration for Defense suggested earlier that the industry should drill 47,000 wells, an increase of more than 11,000 over the 1952 level. An increase of 834 wells to 2,680 has been suggested for Canada.

In 1952 the PAD program for United States drilling was 55,000 wells, but this level was not reached although there was an increase of 1,324 over 1951. The mid-year steel strike which limited supplies of pipe was an important factor in keeping 1952 operations below the PAD program. Success of wells drilled, however, was such that the industry was able to meet its full requirements and increase reserves substantially. It now is generally conceded that the industry has a surplus producing capacity of about one million barrels per day. This is thought by many to be a reasonable safety factor. It may be that PAD will revise its figures downward slightly although it is clear that there can be no very great reduction in drilling if demand is to be met and reserves expanded at a normal rate.

Drilling in the Rocky Mountain area and on the eastern slopes of the mountains through the Williston Basin was a feature of exploration in the United States in 1952.

A third of the seismic work of the nation was carried out in this region. An average of about 250 crews was busy there during the year. Only about five percent of the wells drilled in the United States were in this area, however. The total was 2,357.

Wildcat drilling increased 60 percent

in the region in 1952 to a total of 790. Success ratio was 12.27 percent according to compilations of *Petroleum Information Service*. Discoveries totaled 97 compared with 66 in 1951. A detailed report on the Williston Basin is published elsewhere in this issue.

In 1953 it is anticipated that drilling will be stepped up to test out many of the seismograph prospects reported on in 1952. Wildcat drilling probably will increase to about 1,000 wells and development drilling probably will reach 2,000.

With the highest success ratio of any major area in the country, Texas continues to be the most active producing state. The extent of the Texas land area as compared with other states of course should not be overlooked when comparisons are made.

In 1952 Texas produced a sixth of the crude output of the nation. Of all wells drilled, 37 percent were in Texas. Nearly half of the wildcat completions were in Texas and 34 percent of the development wells. North and West Texas areas are getting the big play.

Oklahoma was second in total wells drilled with 13 percent of the nation's total, but wildcatting activity was at a low level. Only seven percent of the national exploratory tests were completed there.

Kansas was third in total activity with 10 percent of total drilling, eight percent of the wildcats. Louisiana, California and Illinois each completed a little over five percent of the 1952 wells drilled.

During 1952 the oil industry in Canada spent $200 million in exploration work seeking new crude reserves. An additional $100 million was spent in drilling development wells in previously discovered fields.

Approximately 1,200 wells were drilled on the western plains during the year, of which 840 were wildcats and 360 classed as development.

New discoveries were made in 1952 at the rate of about two per week. In the first 11 months there were 158 discoveries of which 81 were oil, 11 wet gas and 66 dry natural gas. Not all of these will prove to be substantial fields, of course. Many will remain an unknown quantity until a greater pipe line outlet is available late in 1953.

There were two developments of major importance in Alberta during 1952. Five miles southwest of Leduc the Wizard Lake, Pigeon Lake, Five Lands area was proved up as a 200 million barrel reservoir and shown to be about equal to Leduc itself.

A second oustanding development was the linking of the Joseph Lake-Camrose-Armena discoveries near Edmonton into a single trend.

Discoveries in the Saskatchewan and Manitoba portion of the Williston Basin are considered an important development of the year as was the activity in the St. John-Peace River district where large gas reserves have been blocked out.

There are now 40 significant oil and gas fields in western Canada. Crude reserves have climbed to 1.7 billion barrels and producing potential to 300,000 b/d on a conservative estimate.

Canada still is producing only about 40 percent of the oil consumed in the Dominion. Result is that the urge to develop more oil is keen. A new pipe line to the oil-thirsty Pacific Coast and an extension of the Interprovincial line to Sarnia will add a further impetus to 1953 and 1954 exploratory drilling. The 4,200 wells in the Dominion now capable of producing will be greatly increased this year.

Although Mexico still is an oil exporter, Pemex officials are beginning to worry a bit about keeping output ahead of demand. Improvements in the domestic economy have caused demand to rise at an annual rate of about seven percent. If this continues, the nation will be consuming about 217,000 b/d by 1958. Current output is about 215,000 b/d.

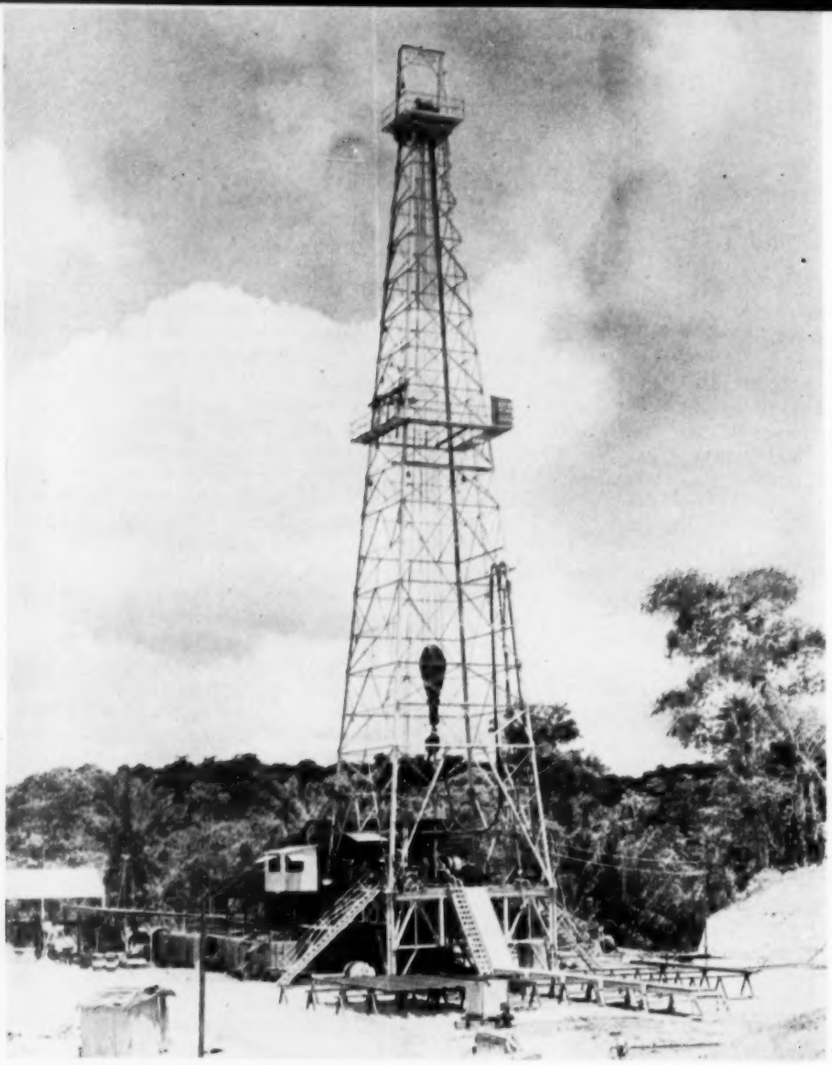
Petroleos Mexicanos hopes to build domestic production to about 460,000 b/d by 1958 so that it will be able to export 50 percent of the national output. To accomplish this, a drilling program of 400 to 450 wells per year has been set up.

During 1952 a number of discoveries were made. Perhaps the most important was the Ordonez field in the Tampico embayment on the trend of Mexico's famous "Golden Lane" discovered in 1903. With only a few wells completed thus far, it appears that Ordonez will be producing 50,000 b/d shortly. Two rigs are running in the field. In the Isthmus region CIMA is developing substantial production for Pemex under its "percentage of production" contract.

Central American operations south of Mexico are limited. Bahamas Exploration Co., a Gulf subsidiary, has been doing gravimeter work in British Honduras and now is undertaking detailed seismic surveys in an effort to find a likely drilling location.

Venezuela's crude production in 1952 averaged 1,803,910 barrels per day, ranging between a low of 1,717,604 in September to a high of 1,861,043 in December. The last week of December saw several all-time highs recorded, with a grand total of 1,901,889 barrels per day for the industry. Creole-operated production was 844,445 in the same period, and Socony's was 64,045, both new highs. The industry average for 1952 represents an increase of about six percent over the 1951 figure of 1,704,643, which in turn was about 13 percent over 1950.

Diesel electric drilling barge recently towed by Shell from Glasgow, Scotland, to Venezuela where it is to be employed for deep drilling on Lake Maracaibo. Shell photo.



Apex (Trinidad) Oilfields Ltd. rig engaged in deep exploratory drilling near San Fernando, Trinidad. Photo courtesy National Supply Co.

Production in 1952 was double that of 1945 which was 886,035 barrels per day.

Some of the newer companies have made relatively great strides: Richmond, with 765 barrels per day in 1948, produced 13,489 in 1952; and Phillips went from 52 b/d in 1946 to 9,586 in 1952.

President A. T. Proudfit of Creole Petroleum has expressed the belief that the two million barrel per day mark will be passed, though not averaged, in 1953. On the other hand, Venezuelan oil will lose markets because of artificially high costs when world productive capacity again exceeds demand, according to Max W. Ball, oil consultant and adviser to governments, including on occasion, Venezuela. Thanks to liberal treatment when her industry was young, Venezuela is now a large producer. However, industry costs have become swollen by "increased royalties, artificial pricing of royalty oil, under-allowance for transportation costs, compulsory refining of oil within the country, adverse currency restrictions, and general and special taxation." The effect is, Mr. Ball says, that wells are not being drilled that should be drilled, and others are being abandoned prematurely because they cannot pay out.

The number of rigs operating in December was 118, an increase of 10 rigs over the total of a year ago. Mene Grande was first with 34, Shell following with 30, Creole with 18. In Western Venezuela 47 were working, 38 on development drilling and nine on exploration; in Eastern Venezuela 69, with 50 on development and 19 on wildcats. 1948 still remains the peak for Venezuela, with 138 rigs running at the end of the year.

Texas Company has revived the El Mamon (or Uramaco) field of Falcon state, east of Lake Maracaibo, which was inactive for many years after a handful of wells had produced a total of 260,000 barrels. Texas recently completed Mamon-8 as a satisfactory producer of 35° oil from somewhere around 4,000 feet, and has spudded Mamon-9. In Guarico, the Texas-Mercedes combine has picked up five additional rigs since about the middle of the year, most of them doing new-pool exploratory drilling around their several fields in western Guarico. The joint Shell-Creole activity in the old Orocual field of Monagas is bringing mixed results, with one shallow well flowing a light-gravity oil and another pumping a low-gravity crude.

Atlantic has resumed operations on Guama-2, joint test with Shell of a block in eastern Guarico, north of the Tucupido-Taman field, which was suspended early in 1952 when floods inundated the site. Atlantic (with Mene Grande and Creole participating) has also spudded Las Ollas-2 in eastern Guarico near the Anzoategui border. Las Ollas-1 was completed as a gas-distillate producer before the war, and has been closed in since. Phillips is proceeding with the development of the Bella Vista field, which is apparently an eastward extension of Atlantic's Ruiz field, which was completely drilled up two years ago. Socony has now commenced drilling its acreage lying between Ruiz and Bella Vista, renting a rig from Creole for the purpose.

In the Greater Oficina area of Anzoategui, Socony has recently made important new-field finds in North Chimire and Oscurote. Pantepec has completed El Roble RPN-29, its first independently-drilled well in that field (where formerly their interests were operated by Creole) as a very successful dual-zoner making 42° API oil, and has been testing RPN-27 deepened into the Merecure in 1952, with unreported results. This is the first of a scheduled eight Merecure wells being drilled by Pantepec with a Clint Murchison company.

Creole recently resumed drilling in its Pilon field in southern Monagas, after shutting it down in 1948, and has completed three wells under 4,000 feet producing oil of less than 15° gravity, two solely-owned and one joint with Mene Grande. Shell, with Burgua BU-1 down below 8,000 feet and still drilling in a remote part of the Venezuelan Andes 40 miles from San Cristobal, has spudded Friata-1 near the village of La Fria, between the marshes of southern Lake Maracaibo and the western slope of the Andes.

Sinclair has spudded wildcat Sinco-1 in the little-known Barinas region which is sometimes called the future third great oil basin of Venezuela. Socony, with several wells completed in Barinas and land already bought for a terminal and refinery site at Puerto Cabello, is said by a leading newspaper to be taking no further steps to connect the two points with the necessary 250-mile pipeline until and unless they get more concessions. The same paper suggests that the river route might prove to be the best way to get out the (as yet hypothetical) oil of Barinas-Apure, in which case the Orinoco might be dredged upstream to the mouth of the Apure.

Mene Grande has completed new-field wildcat Silla-1 in the Greater Oficina area as an excellent producer from two sands, and the log is said to have indicated the presence of upward of six other well-developed sands which will be tested in subsequent wells. In Western Venezuela, Mene Grande also has discovered Paleo-

cene-Eocene (Guasare formation) production at less than 5,000 feet in the Mara field, where the big play since 1945 has been the very deep and prolific but erratic Cretaceous limestone at 10,000 feet and below. Meneg's first Guasare producer is flowing about 1,000 barrels per day of oil of about 35° gravity. This is the more remarkable since most previous occurrences of Guasare oil in Mara have been of 15° gravity or less, besides being non-commercial. If some of the other operators in Mara can strike Guasare production, it will be still another shot in the arm for this area, which produced moderate quantities of Eocene (but not Guasare formation) oil for years before dazzling Venezuelan operators with really big wells (30,000 barrels per day record) from the Cretaceous.

Production in Colombia has been relatively steady for the past two years at about 106,000 b/d. The country has a very large unexplored area favorable for oil accumulation and may become one of the world's greatest producers in the future. Wildcatting has not been very active in recent years however.

Most important development in Colombia recently was the discovery of oil in the Cretaceous horizon by International Petroleum Co. (Colombia) Ltd. in the middle Magdalena valley about 75 miles from the company's earlier De Mares concession which has reverted to the government. The discovery was made late in 1951. Step out and deeper drilling now is being done.

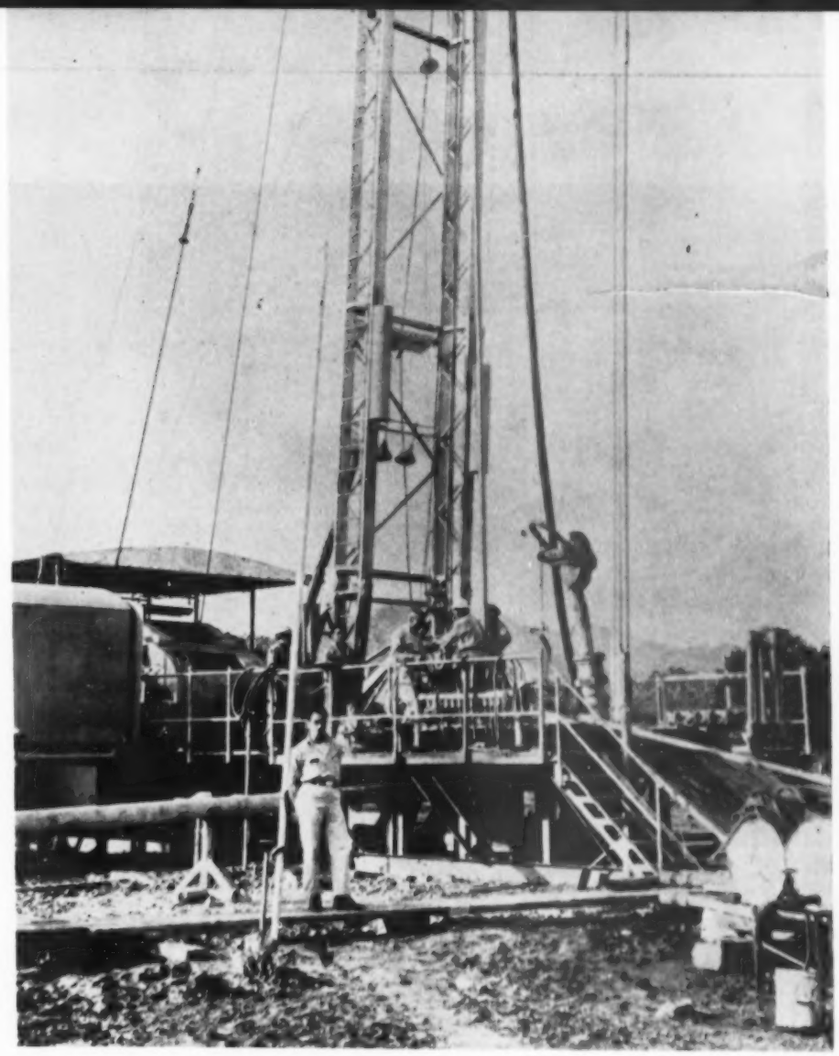
The Cretaceous has proven highly productive in Venezuela and the International find on its 120,000-acre Totumal concession is considered significant. Only other Cretaceous production in Colombia is on the Venezuela border.

Colombia Petroleum Co. has taken a 124,000-acre concession west of its Barco block which now is producing about 28,000 b/d. It is anticipated that exploratory work will be begun on this block before long.

Production from the province of Magallanes at the southern tip of Chile was increased materially in 1952, but still averages less than 3,000 b/d. Some eight small fields have been discovered by Chile since 1945. Five rigs are kept busy in the area.

Manabi Exploration Co. has planned to drill several wildcat and development wells this year in Equador and to study methods of stimulating production in presently producing wells. A gas discovery was made in 1952.

The recent adoption of a new petroleum law by Peru and the granting of a number of new concessions is expected to stimulate future exploratory work in that country. In recent years, production has been relatively level at about 44,000 b/d. An account of Peruvian activities in detail is given elsewhere in this issue.



Sharmex, S.A., trailer-mounted rig which drilled five 3,000-foot wells in Mexico in five operating months recently. A 95-foot mast is mounted. National Supply photo.

Brazil is continuing its policy of drilling a number of deep wildcats. Consumption is soaring and a number of new refineries are under construction so that the need for Brazilian oil is great. There is a very large area still untested, but under government operation, it is not possible to develop an all-out search for new oil.

Barbados Gulf Oil Co., Ltd., has begun drilling a deep test on the island of Barbados. The location was made after an extensive geophysical study in the 100 square mile area in which this Gulf subsidiary has a license.

In Cuba the Gulf company, which has been exploring there for several years, had another dry hole in 1952. The wildcat was drilled off the north coast and abandoned at a total depth of 11,218 feet. Geological, field and laboratory work is continuing, but no new wells have been spudded.

Active exploration and development work is under way in Trinidad where Trinidad Leaseholds Ltd. is operating nine rigs in the exploitation of its properties on the island. Production is being maintained by its own and joint operations with partners at a rate in excess of seven million barrels per year. A one-third interest is owned in Trinidad Northern Areas Ltd. which continues to be active in deep exploration on its land concessions and, in addition, has licenses on marine concessions off-shore covering 228,000 acres.

Geophysical surveys, both gravity and seismic, have been made on these marine leases and preparations are now being made to carry out drilling on them in the Gulf of Paria which divides Trinidad from Venezuela.

During the past year Apex (Trinidad) Oilfields Ltd. has completed five wells in its main field and four in the South Quarry area.

A test well is being drilled on the eastern part of the synclinal zone with the object of testing whether the Penal Oligocene structure extends under the field. This well is programmed to a depth of 15,000 feet if necessary and is already down over 9,000 feet. Seismic surveys under contract are also being carried out in this district.

The Shell group has two drilling rigs operating in Trinidad as well as a seismic party and a geological party.

ARAMCO field operations

By E. Lawson Lomax

THOUGH SAUDI ARABIA is younger in the development of its oil fields than either Persia or Iraq, it has been in some ways the most spectacular petroleum reservoir of the Middle East. Along with Bahrain, which geographically is part of the Arabian peninsula, it is the only concession that is wholly under American ownership. The original concession, granted to Standard Oil Company of California, was later shared with The Texas Company. More recently Standard Oil Co. (N.J.) and Socony-Vacuum Oil Company, through substantial investments, became members of the group, the three first named now owning each a 30 percent interest while the fourth holds 10 percent. Thus the name first given it, The Arabian American Oil Company, still logically applies.

The company's concessions, enlarged beyond the original grant, cover approximately 140,000 square miles, of which a relatively small part thus far has been thoroughly surveyed or tested by the drill.

The discovery well on Aramco's holdings was brought in in 1938 at Dammam where the first tests were made. Commercial production, starting on a modest scale from this area in 1944 with an output of roundly a million tons, has risen rapidly since that time to 36,608,585 tons (approximately 761,541 barrels daily) in 1951 and to 420,000,000 tons (824,756 barrels daily) in 1952.

Current production is derived from four fields whose average daily outputs are as follows:

Field	Average b/d
Dammam	63,000
Abqaiq	440,000
Qatif	35,000
Ghawar (Ain Dar area)	300,000
	838,000

These fields are being produced at rates commensurate with shipping facilities and market requirements, but the quantities are not an indication of their present or future capacities, which are at a much higher level.

One of the notable recent advances is that in the Ghawar field. Originally, it was considered that the Ain Dar, Uthmaniyah and Shedgum fields were separate entities, but recent work on their development has proved that they are parts of one large field which has been named Ghawar.

The present proved length of this field is 62.5 miles, with a width varying from 1½ miles at its narrowest part of 10 miles at its widest point. The length of 62.5 miles covers the proven area, but the southern boundary has not yet been established so its final extent may be greater.

In this field the present state of development is approximately as follows:

Ain Dar Area: In this area a total of 37 wells has been drilled, and there are one or two more to be sunk in order to complete the drilling program, one rig being at work now. There are four completed de-gassing stations, each station having a rated capacity of 100,000 to 130,000 barrels per day.

Uthmaniyah Area: In this area 26

wells, all potential producers, have been sunk, but the field is not yet drilled up. Three rigs are at present at work. To date no actual production has been made, the area being held in reserve. The first de-gassing station is being erected and is rated at the same capacity as those in the Ain Dar area.

Shedgum Area: Four wells have been completed in this area, the last at the end of November 1952, while the fifth well is now drilling. All these wells are potential producers.

Abqaiq Field: Abqaiq is presently the largest producing field of the concession, having an average production of 440,000 b/d, and is drilled up. Sixty-six wells have been drilled, of which 62 are producing, one is shut in, and the other three are used as observation wells.

Dammam Field: Steady production is being maintained from Dammam and there is no immediate project for its further development. A total of 40 wells has been sunk, of which two are shut in, and nine have been abandoned, leaving a total of 30 producers, two of which are gas wells. The de-gassing stations are capable of handling the optimum production from this field.

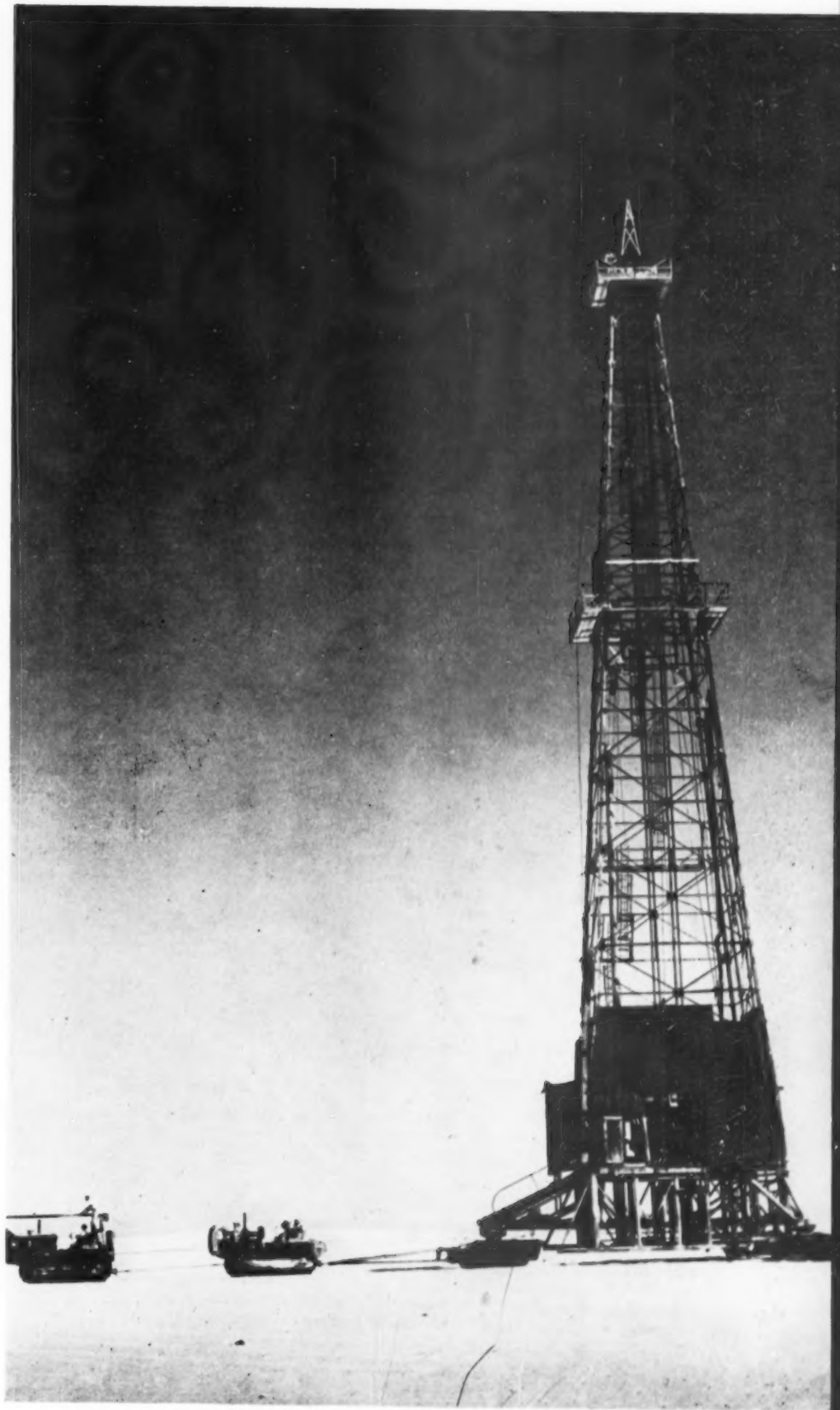
Qatif Field: In this field there are six producing wells and four wells are shut in. There is one observation well, while the other two are non-productive. In connection with this field, there are three degassing stations completely under the control of Arab personnel, who appear well able to carry out this operation and whose house-keeping is of a high standard. At present this reservoir is being studied to determine whether development of the field is justified.

Abu Hadriya Field: In this field three wells have been drilled, one of which is a potential producer and has been shut down pending future developments; one well is suspended and the other abandoned.

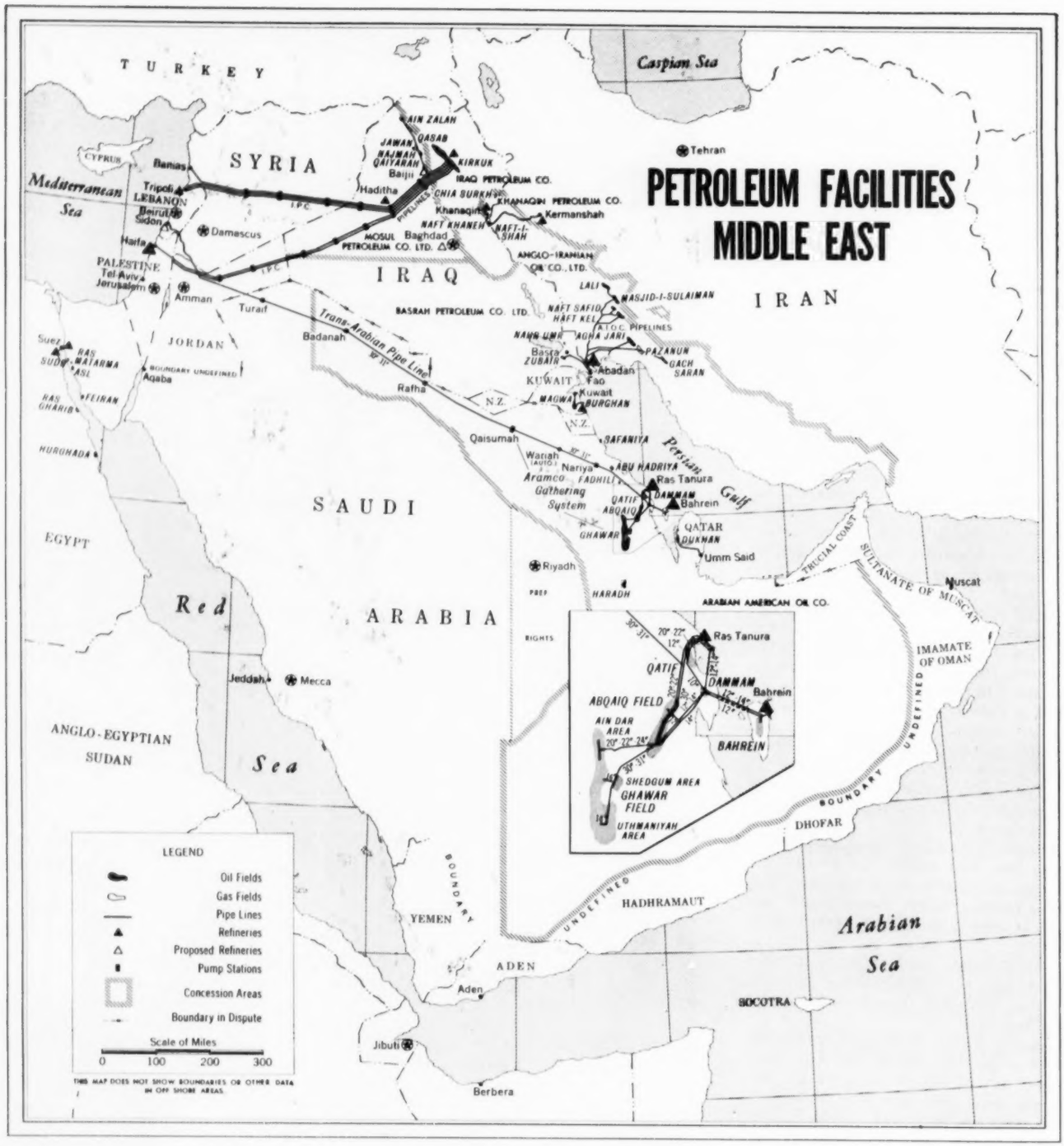
Fadhili Field: One well has been drilled in this field, which is a potential producer, but has been shut down pending future developments.

Haradh Field: This field is situated south of Ghawar. Seven wells have been drilled, six of which are potential producers, while one has been suspended. This field has not yet been put in production.

Safaniya Field: This field is situated on the shore of the Persian Gulf, about 20 miles from the boundary of the neutral zone between Kuwait and Saudi Arabia, a portion of it extending under the surface of the Gulf. Drilling in this location



A 136-foot derrick being towed across the desert to a new well site near Abqaiq, the Arabian American Oil Company's oil field community in Saudi Arabia. The problem of crossing bridges and streams does not exist, but sand dunes often are a problem.



is being carried out by means of the "Queen Mary" diesel-electric drilling barge, which Aramco bought from the Creole Petroleum Corporation in Venezuela and towed from there to its present location. Ten wells have been drilled in this field, omitting No. 8, the last being numbered eleven. Oil has been struck in all the wells except the last one, a non-producer, which probably marks the extent of the field in that direction.

In addition to the "Queen Mary," two rigs are in operation in the Shedgum area, one in Ain Dar, and three in Uthmaniyah. Two are engaged in work-over and one is held in reserve.

All working rigs are in radio communication, both with each other and with the head office so that any undue occurrence can be dealt with immediately.

In addition to these rotary rigs, two cable tool rigs are working for production from the Eocene and Miocene formations of water supplies.

A large plant is being constructed in the Abqaiq field for injecting high pressure gas from the separators into the top of the structure. This plant is due for completion in the fall of 1953.

It is intended that the plant will recompress the high pressure gas from the first stage of the three de-gassing stations and then inject it into the formation. By this means it is hoped to obtain a correspondingly increased production from the field. On its success will depend the in-

stallation of further plants for this purpose. Intensive studies are also being made of the feasibility of water injection into the lower formation with the same end in view.

Planning of future development is an important Aramco function in view of the vast holdings of the company. The evaluation of these concessions involves exploratory work in a land which is largely desert and devoid for the most part of water and food supplies.

Exploration crews have to be self-sustaining in every way. They must have their own transport, living accommodations, food supplies and means of communication with headquarters, while the central office must be kept informed and must be able to send out supplies to working parties as required. Several exploratory crews are regularly out on location doing field mapping, triangulation, gravity, magnetometer and seismograph surveys and structural drilling, and all the necessary work for proving the presence or otherwise of deposits of petroleum, together with general mapping of the territory.

The southern portion of Saudi Arabia, which has an area of about 300,000 square miles, remains largely an unexplored and uninhabited land, consisting in the main of desert sand and gravel, with high sand dunes and mountains.

Its Arabic name is "Rub al Khali," literally meaning the "Unknown Portion" and that aptly describes it. It is in this region that a large amount of exploratory work is being done.

Since the opening of the railway from the Persian Gulf port of Dammam to Riyadh, the capital of Saudi Arabia, it has been used for transport of exploratory equipment as far as Haradh, but beyond that (and the camps may be 200-300 miles farther into the desert) transport must be self-supporting.

Aramco has evolved specialized transport for this desert travel in the form of vehicles equipped with oversized low pressure tires for traveling over loose sand, extra large cooling systems and auxiliary fuel tanks. All vehicles are equipped with compasses, and in many cases with radio communication equipment, so that in the event of breakdown, assistance can be requested.

Wherever possible, one of the early tasks of the exploration gang is to level out and mark an air strip, so that rapid communication between headquarters and camp can be established. Besides providing rapid transport for personnel requiring medical aid, either due to accident or the ordinary exigencies of life under arduous conditions, it also provides a means of feeding the camps with all kinds of fresh stores and mail and of relieving personnel.

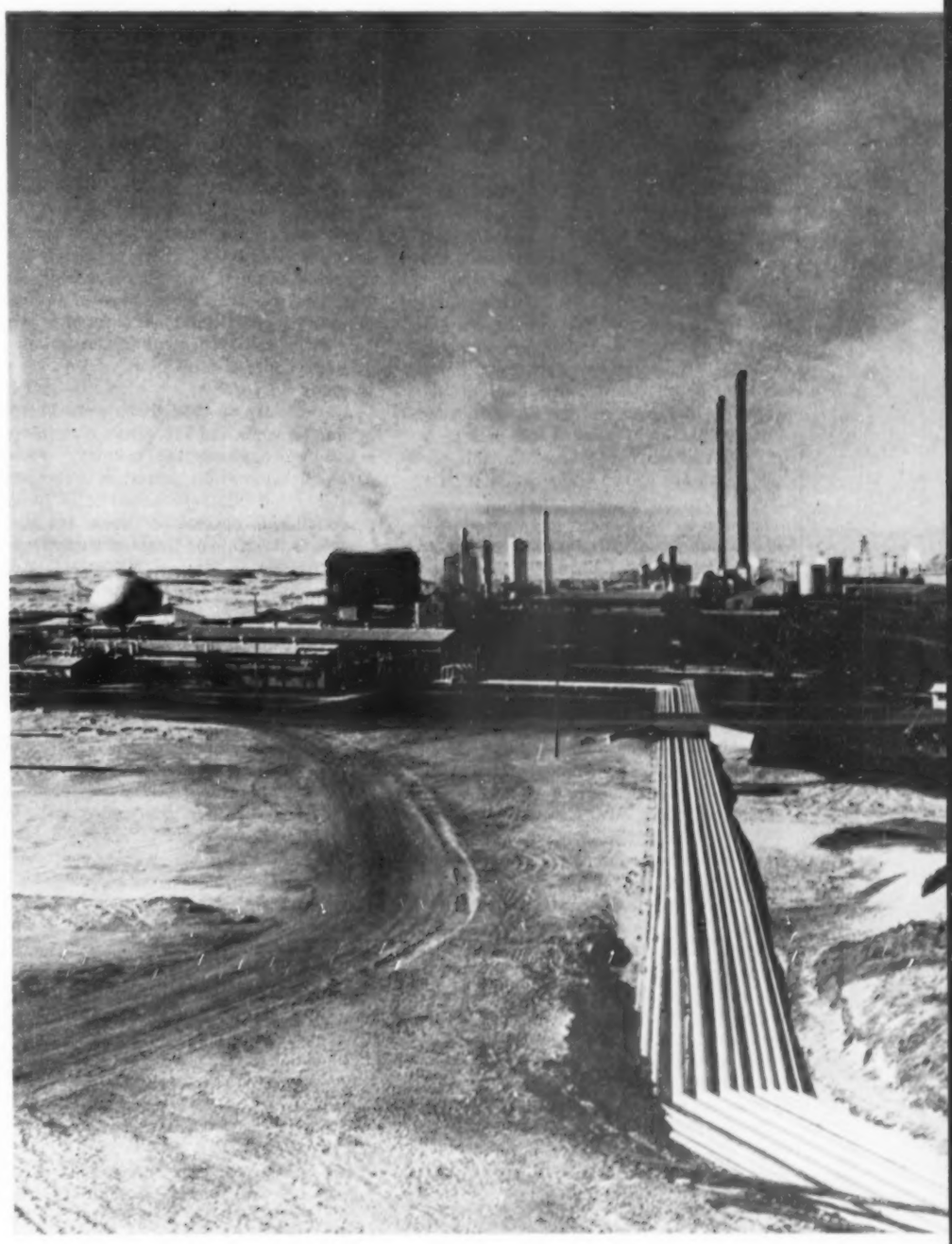
This work is carried out in the cooler months of the year, that is from September to June, the weather between June and September being so hot as to render work very difficult. This period is used for reconditioning of equipment, classifying the information gathered and also giving long leave to personnel.

The actual period during which a crew is on location during the colder months is about five weeks, interspersed with a six day leave for each five weeks in the field.

This exploratory work, although of extreme importance to Aramco itself, is carried out to fulfill the company's obligation under the terms of its concession agreements.

Aramco supplies crude oil to its own refinery as Ras Tanura, the refinery of the Bahrain Petroleum Company Ltd., and also ships crude oil through Tapline and by tanker from Ras Tanura to its parent companies for refining and sale under their own branded names.

(Please turn to page 110)



Aramco's Dhahran stabilizer plant near the headquarters community of Dhahran in eastern Saudi Arabia where noxious and unusable gases are removed from the crude before shipment.

Venezuela tapped reserves to meet 1952 demand

By H. J. Struth
Petroleum Consultant

CRUDE OIL PRODUCTION in Venezuela in 1952 topped all previous records with a daily average of 1,798,385 barrels, an increase over 1951 of 93,700 barrels daily. To accomplish this, however, it was necessary to dip into the nation's crude oil reserves to the extent of some 81,209,000 barrels. Thus, for the first time in many years, there was an interruption in the upward trend of reserves. Preliminary estimates place Venezuela's crude oil reserves at the close of 1952 at 8,950,000,000 barrels, compared with reserves at the close of 1951 of 9,031,000,000 barrels.

This indicated deficiency brings into focus the urgent need for new concession grants by the Venezuelan government. The facts indicate definitely that there has been a consistent contraction in the concession holdings of the various operating companies. Between 1948 and 1952 the combined concession area available for exploration has shown a shrinkage of 21.4 percent. At the close of 1951, the combined area in concessions aggregated 15,549,000 acres, compared with 19,792,000 acres of prospective oil territory under exploration in 1948.

Company concessions which have reverted back to the government during this period ranged as high as 52.1 percent, while holdings of minority interests were reduced by 60.2 percent. As of January 1, 1952, the total area of proven oil and gas fields comprised about 667,000 acres, which represented 4.3 percent of the total acreage in concessions. The figures in Table I tell their own story.

While the search for new sources of oil supply in 1952 was intensified by the principal operators, the results were not commensurate with the effort and expenditure involved. This is demonstrated by the relatively small quantities of new reserves opened to development in 1952. Preliminary estimates indicate that discoveries aggregated some 577,000,000 barrels, compared with 933,000,000 barrels reported in 1951 and 1,084,000,000 barrels discovered in 1949. Advance data indicate that the ratio of reserves to production dropped to 13 in 1952, against a ratio of 18 in 1950. The situation with respect to reserves and production is shown in Table II, a tabulation of the figures made available for the past five years.

Drilling operations have been accelerated during the past two years, reversing the declining trends established during 1949 and 1950. Total wells drilled in 1952 amounted to 1,135, against 1,076 in 1951, and only 655 in 1950. Monthly drilling statistics are reported in Table III.

The breakdown of drilling operations in Western and Eastern Venezuela shows that nearly 62 percent of the wells were drilled in the west, largely in the Lake Maracaibo area. Most of the drilling there was in the development of proven areas, which resulted in the extremely low dry hole ratio of only three percent. In Eastern Venezuela, where most of the exploratory operations took place, the dry hole ratio was 17 percent. The combined average dry hole ratio in all of Venezuela was only 8.4 percent.

At the close of 1952 there were 11,200 producing wells and 115 active rigs in operation throughout the country. Final data on exploration activities were not available for this report, but it is likely that wildcat operations were confined largely to the state of Guarico, Anzoategui and Monagas, in Eastern Venezuela. Advance information indicates that the new fields discovered in 1952 were of relatively minor importance, although later development may prove them more favorable.

Crude oil production in 1952 rose to a new high level of 1,844,407 barrels daily during the month of May. The effect of reduced market prices for heavy fuel oils during the summer and fall of 1952, attributed to the oversupply of that product in the United States, was reflected by a steady downward trend in crude oil production in Venezuela. This continued through the months of June to November, when there was a resumption of the upward trend in production. Monthly crude oil production statistics of the past two years are presented in Table IV with comparative annual statistics for the years 1948, 1949 and 1950. The cumulative production of crude oil through the year 1952 is estimated at a total of 6,822,631,000 barrels.

Venezuela has produced since 1914 a total of 6,822,631,000 barrels of crude oil. This comprises 43.3 percent of all the proved reserves discovered to date. In the past five years, 1948-52, Venezuela has produced 41 percent of all the oil produced to date. With the growing world demand for petroleum and its products, there is every reason to believe that Venezuela will continue to occupy an increasingly important position as a future source of oil supply. Venezuelan government officials, as well as the oil companies who operate in that country, anticipate the need for a rate of production well above 2,000,000 barrels daily in the immediate future. Any further increase in oil production in Venezuela, however, will of necessity involve an expanded program of exploration. Sooner or later this will call for the promulgation of agreements in the form of new concessions.

Venezuela, like the United States is confronted with the problem of maintaining an adequate margin of potential supply above future productive requirements. Highly important in this connection is the fact that the reserves to production ratio has declined in the past three years from 18 to only 13. Venezuelan oil wells are backed up by reserves which are about 13 times greater per well than those in the United States. Yet, by the same token, due to unit operation of concessions, the rate of production per well is likewise 12 to 13 times that of the average oil well in the United States. In the final analysis, Venezuela should be concerned, just as much as the United States oil industry is concerned, with the maintenance of an adequate margin of potential oil supply.

The "big three" companies — Creole, Shell and Mene Grande — produced over 90 percent of Venezuela's oil in 1952. Since 1949, these three companies have increased their combined crude oil production by nearly 35 percent, which accounted for the total increase reported for the country. Table V shows the annual daily crude production by companies for the past four years. Averages for 1952 are based upon official reports for the first ten months.

Imports from Venezuela by the United States in 1952 aggregated about 153,000,000 barrels, which amounted to a daily average of about 418,000 barrels. In 1951, the United States imported about 362,000 barrels daily from Venezuela, exclusive of products received from Caribbean refineries. If receipts by the United States from Aruba and Curacao are combined with direct shipments from Venezuela, the total volume brought into the United States comprises about 39 to 40 percent of all the oil which originates in Venezuela. Incomplete data indicates that exports of crude and products from Venezuela to all parts of the world aggregated in 1952 at least 625,000,000 barrels, which comprised about 94 percent of the original petroleum liquids production of the country. This indicates that domestic consumption probably amounted to from 38,000,000 to 40,000,000 barrels, which was an increase over 1951 of some 14 percent.

Refining operations continued to expand in 1952. Enlargement of Creole and Shell refineries on the Paraguana peninsula, at

Amuay and Punta Cardon, coupled with a new plant placed in operation by Phillips Petroleum Company at San Roque, brought the nation's daily refining capacity to a new high level of about 415,000 barrels. Final data on runs of crude to stills and product yields were not available for this report, but it is likely that runs were of the order of about 350,000 barrels daily. Daily average still runs in 1951 were reported at 315,000 barrels daily. This is roughly about 20 percent of the country's crude oil production.

The reduction in U. S. crude oil tariffs, through reciprocal trade agreements, averaging 5¼ cents per barrel, resulted in offsetting price advances which were announced by Creole Petroleum Corporation on October 11, 1952. The new price postings for heavy crude oils were advanced five cents per barrel for the following grades:

Grade	Gravity	Price per Barrel
Bachaquero	14-14.9	1.66
Tia Juana	19-19.9	2.03
Lagunillas (Heavy)	(Flat price)	2.05
Quiriquire	18-18.9	2.29
Temblador	20-20.9	2.33

The new 26-inch oil pipe line from Ule to Amuay, a distance of 143 miles, is being operated at capacity by Creole Petroleum Corporation. The company is also building a new 34-inch line from Lagunillas to La Salina. Of far-reaching importance to future world movements of oil from Venezuela is a recent contract awarded to Walter Gahagan of Caracas for dredging a deep water channel into Lake Maracaibo. This project will cost about $36 million. It will ultimately permit large ocean tankers to enter the lake, and will eliminate great difficulties that have long been encountered in moving oil with shallow draft tankers, with consequent reloading operations at deep-water Caribbean terminals.

Progress continues to go hand in hand with petroleum developments in Venezuela. Revenues derived from oil are being used by the government to improve the economic and industrial life of the country. Increasingly larger funds are being made available for building new highways, new health and recreation centers, deep-water harbors, and for the extension of educational facilities to a continually larger segment of the population.

The sincerity of purpose which pervades the rank and file of those who administer the affairs of the petroleum industry through the Venezuelan government provides a climate of democracy which is highly favorable to the encouragement and investment of outside capital. Many American oil operators have expressed a desire to develop oil production in Venezuela, and await such opportunities as may be made available in the near future through the granting of new concessions.

This is a preliminary report, to be followed by a complete survey of Venezuelan oil developments in an early issue.

TABLE I

CONCESSION HOLDINGS OF COMPANIES

Thousands of acres

Company	1951	1948	% Decrease
Creole	3,495	4,694	25.5
Shell	3,175	3,897	18.5
Mene Grande	2,448	2,876	14.9
Socony Vacuum	1,860	1,898	2.0
Texas Co.	1,269	1,468	13.6
Sinclair	1,207	1,466	17.7
Richmond	627	1,308	52.1
Atlantic	795	752	+5.7
Phillips	178	188	5.3
Others	495	1,245	60.2
Total	15,549	19,792	21.4

TOTAL ACRES IN CONCESSIONS

1951	15,549,000
1950	15,844,986
1949	18,053,907
1948	19,791,591

TABLE II

VENEZUELAN CRUDE OIL RESERVES

(Million Barrels)

	New Reserves Discovered	Crude Production	Surplus Added to Reserves	Est. Reserves Dec. 31	Ratio Reserves to Prod.
1948	838	490	348	7,644	15
1949	1,084	482	602	8,234	17
1950	968	547	421	8,720	18
1951	933	622	311	9,031	14
1952*	577	658	—81	8,950	13

* Preliminary estimates

TABLE III

WELLS DRILLED IN VENEZUELA, 1952

	Productive wells	Dry Holes	Total
January	102	6	108
February	92	15	107
March	105	13	118
April	39	3	42
May	95	10	105
June	96	6	102
July	102	13	115
August	61	7	68
September	61	5	66
October	103	5	108
November*	94	7	101
December*	90	5	95
Total	1,040	95	1,135
Year 1951	**	**	1,076
Year 1950	**	**	655
Year 1949	**	**	682
Year 1948	**	**	886

* Preliminary estimates

** Not reported

DRILLING OPERATIONS IN MAJOR AREAS, 1952

	Western Venezuela	Eastern Venezuela	Total
Productive wells	679	361	1,040
Dry Holes	21	74	95
Total	700	435	1,135
Percent dry	.03	.17	.084

TABLE IV

VENEZUELAN CRUDE OIL PRODUCTION

	Year 1952 Total	Year 1952 Daily Average	Year 1951 Total	Year 1951 Daily Average	Percent Increase
January	56,162,000	1,811,693	50,667,000	1,634,410	10.8
February	53,024,000	1,828,421	45,807,000	1,635,961	15.8
March	56,418,000	1,819,949	52,031,000	1,678,420	8.4
April	54,899,000	1,829,967	50,683,000	1,689,417	8.3
May	57,177,000	1,844,407	52,649,000	1,698,361	8.6
June	54,739,000	1,824,642	50,983,000	1,699,422	7.4
July	55,898,000	1,803,154	53,231,000	1,717,132	5.0
August	53,469,000	1,724,818	52,980,000	1,709,024	0.9
September	51,528,000	1,717,604	51,757,000	1,725,246	—0.4
October	54,795,000	1,767,582	53,717,000	1,732,808	2.0
November*	54,300,000	1,810,000	52,625,000	1,754,164	3.2
December*	55,800,000	1,800,000	55,068,000	1,776,386	1.3
Total	658,209,000	1,798,385	622,198,000	1,704,652	5.8
Year 1951	622,198,000	1,704,652			13.8
Year 1950	546,765,000	1,497,985			13.4
Year 1949	482,299,000	1,321,367			—1.3
Year 1948	489,998,000	1,338,794			12.6

* Preliminary estimates

TABLE V

VENEZUELAN CRUDE OIL PRODUCTION BY COMPANIES

(Daily Averages)

Company	1949	1950	1951	1952 (10 Mos.)	Percent of Total
Creole	624,505	685,839	773,663	804,220	44.8
Shell	409,983	461,601	527,321	550,523	30.6
Mene Grande	169,191	202,211	245,273	269,793	15.0
Socony	35,951	37,003	49,319	57,796	3.2
Mercedes	15,581	18,706	23,177	25,056	1.4
Richmond	3,629	12,502	13,489	20,526	1.1
Texas	23,357	25,711	23,625	19,357	1.1
Atlantic	11,692	20,944	18,923	17,378	1.0
Sinclair	15,190	12,598	12,481	12,997	0.7
Phillips	4,852	7,492	6,371	9,904	0.6
Pantepec	6,274	12,318	10,042	8,578	0.5
British	1,063	995	949	942	—
Guasare	99	65	1	—	—
Total	1,321,367	1,497,985	1,704,652	1,797,070	100.0

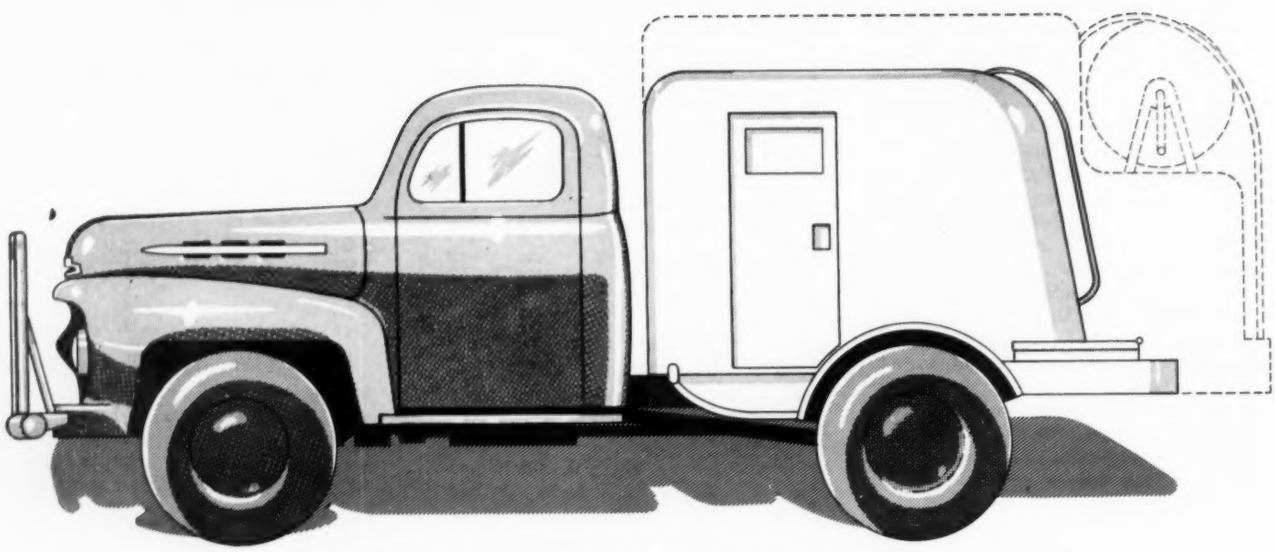


Fig. 1. Modern truck-mounted reflection seismograph unit showing size comparison between present-day and older, larger seismograph equipment.

Modern Changes Aid Efficiency Of Seismographic Equipment

By D. G. O'Brien

IN RECENT YEARS many changes have been made in the physical appearance and operating efficiency of truck-mounted reflection seismograph equipment. The changes in physical size have been brought about because of the smaller-sized instruments which have been made possible by the ready availability of high-performance miniature components such as small vacuum tubes, and by new circuit techniques which allow the construction of smaller instruments which are more versatile and efficient in operation than were the older and larger devices.

The resultant decrease in the size of the instrument truck has made possible more efficient operation of the unit because of the ready accessibility of the various controls and has also made it possible for the instrument truck to operate over terrain which was formerly considered too rough for instrument-truck operation. This latter change has been brought about because of the reduced weight, lower center of gravity and better weight distribution of the unit.

More attention has also been paid to the comfort of the operator. The trucks as presently constructed are well-insulated, draft-proof and rattle-free and, in addition, are usually equipped with a high-output heater which maintains the temperature of the truck at a level which provides comfort for the operator and allows increased efficiency because the temperature of the photographic chemicals is maintained at a level where fast photographic processing is possible.

D. G. O'Brien holds a B. S. degree in electrical engineering from the University of New Hampshire and an M.S. degree in electrical engineering from the Massachusetts Institute of Technology. He is vice president and chief engineer of Midwestern Geophysical Laboratory, Tulsa.

The physical appearance of the modern reflection seismograph unit is shown in Fig. 1. The decrease in size which has been brought about because of the factors mentioned above is shown diagrammatically.

Changes in appearance of the electronic units which constitute the actual truck-mounted instrumentation are noticeable primarily from the standpoint of size reduction and decrease in the number of the electronic tubes which are necessary. A photograph of a modern seismograph amplifier is shown in Fig. 2. A unit of this type is preferably constructed on a stainless steel chassis and is equipped with a stainless steel front panel. The choice of this material is dictated by the

necessity for constructing equipment which is not adversely affected by continual exposure to the chemicals usually employed in photographic processing. It should be strongly emphasized that the reduction in size has not been brought about by decreasing the usefulness or versatility of the equipment. Indeed, the opposite is true. Modern-day seismograph equipment in spite of its reduced size is more useful and versatile by a factor of at least two than was the equipment of ten years ago.

As an example of this change, present-day equipment is frequently equipped with as many as six high-pass and eight low-pass filter positions. In addition, some companies are providing variable amounts of attenuation in the high-pass filter positions, the nominal cut-off frequency being maintained the same for each of these variable attenuation adjustments.

The auxiliary pieces of electrical equipment which are necessary, such as power supplies, communication units, test units and interference eliminators, have also been reduced in size and improved in performance.

One of the many remarkable changes in seismograph equipment is evident when one compares the physical appearance and performance ability of present-day oscillographs and galvanometers with those which were in use not too many years ago. Photograph of a modern oscillograph is seen in Fig. 3 and a modern galvanometer in Fig. 4. Perhaps the greatest change from the standpoint of size has occurred in the galvanometers, those expensive but very necessary devices which transform the electrical output signal from the seismograph equipment into a moving light beam which, when it impinges upon the photograph medium, provides a visual record of the electrical phenomena brought about when the dynamite explosion occurred and the resulting energy excited the geophones used to transform ground motion into an electrical signal. This size reduction is apparent in Fig. 5 which shows diagrammatically the relative size of a modern galvanometer as compared with one of the older galvanometers. Here again the reduction in size has not been brought about by reducing the efficiency of the unit. In fact, modern-day galvanometers are many times more sensitive than older galvanometers by a factor of 10 and in addition are more rugged, subject to much less operational troubles and are long-lived under severe field operating conditions.

One might well ask what changes in design philosophy have caused the substantial changes which have taken place in seismograph equipment over the years. The basic design objective has, of course, remained about the same; namely, to construct effective, economical equipment which is capable of obtaining the maximum amount of accurate information in the shortest possible length of time and with the least expenditure of funds. This philosophy, of course, applies to almost any piece of equipment regardless of the field of application. In order to realize the factors which influence the design of the specific pieces of equipment, let us consider specific examples.

First, consider the case of the geophone, the device which ordinarily transforms ground motion into a voltage output signal. Present-day thinking, although all designers do not subscribe to this particular view, has been that all of the filtering of the electrical signal which is generated by the geophones should take place in the seismograph amplifier. Such thinking was not always prevalent and, indeed, many designers today have a somewhat different view on this matter.

Several years ago geophones were constructed with comparatively high undamped natural frequencies. Since the voltage output of a geophone decreases rapidly for ground velocities of a frequency which is lower than the undamped natural frequency of the geophone, instruments with high undamped natural frequencies were effectively acting as high-pass filters inasmuch as they did not allow unattenuated passage of such low frequencies. As an example of this factor, many of the older geophones have undamped natural frequencies of around 25 cps. Present-day geophones, however, are likely to have undamped natural frequencies ranging between six and 15 cps. The idea behind the high natural frequency of the older style geophones was indeed valid; they provided elimination of low-frequency ground roll which interfered with the legibility of the seismogram. Unfortunately, however, there were occasions when shooting was conducted in certain areas where much useful information was contained in the portion of the frequency spectrum which the higher frequency geophones attenuated. With modern-day equipment, while the geophone's natural frequency is low enough to pass virtually all signal frequencies of interest, ground roll frequencies, if troublesome, can be cut out by means of the amplifier's filters and low signal frequencies of interest can be passed when desired by setting the high-pass filters on lower values.

In addition to the above-mentioned features, present-day geophones have been reduced in size and weight and have been made less sensitive to velocities which are not in a vertical plane. They have also been designed with higher sensitivities than the old models possessed. These improvements have been brought about by increased knowledge of efficient magnetic circuit design and by the availability of much improved magnetic materials, such as Alnico V.

Perhaps more time and thought have been devoted to the design of the geophysical amplifiers than to any other portion of the equipment. This is to be

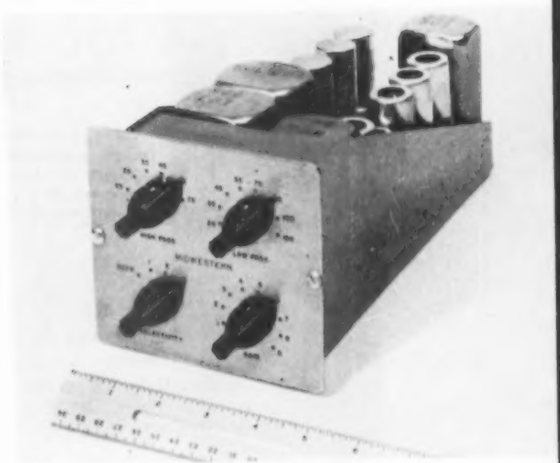
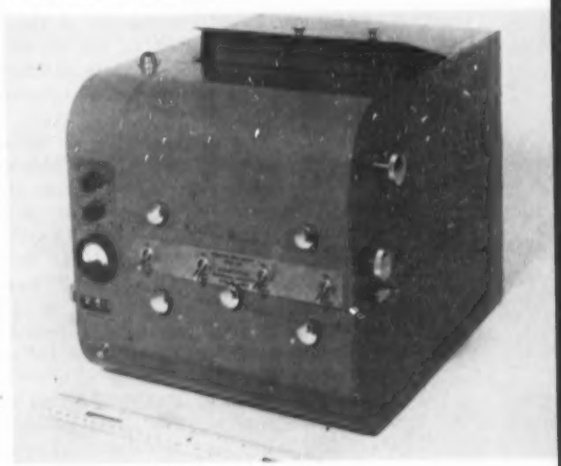


Fig. 2. Modern reflection seismograph amplifier.

expected, however, since the amplifier is the very heart of the equipment and is called upon to perform the most complex function of any of the pieces of equipment in the chain between the geophone and the galvanometer. The three principal functions of the amplifier are: (1) amplification, (2) filtering, and (3) automatic gain control. Obtaining sufficient amplification with the minimum number of electronic tubes has been simplified by the ready availability of modern miniature vacuum tubes in a variety of types. A maximum gain of one million is obtained in an implifier having as few as five to seven tubes. The fairly recent widespread application of mathematical techniques such as the LaPlace transformation to the field of electrical engineer-

Fig. 3. Modern oscillograph.



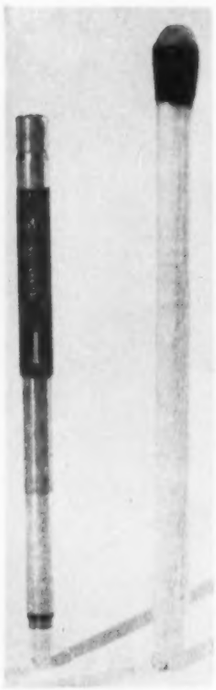


Fig. 4. Modern galvanometer (ordinary kitchen match shown for size comparison).

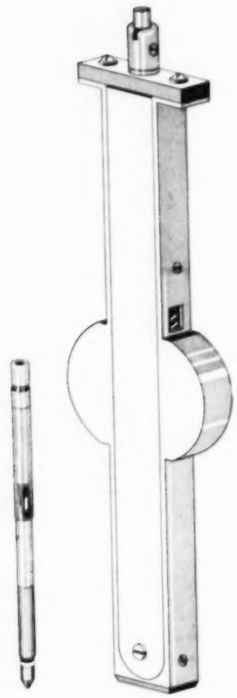


Fig. 5. Size comparison between present-day and older, larger galvanometers.

ing has made possible the easy and accurate synthesis of passive filter circuits which are capable of performing the function desired by the design engineer. Using these techniques, filters have been designed which provide the type of filtering desired and at the same time minimize the undesirable transient response of the older-type filters which utilized tuned circuits. The purpose of this design has been to reproduce with a minimum of distortion the actual signals which have been generated by the geophone over a band of frequencies which eliminates undesirable interference such as ground roll and wind noise. The need for a well-damped transient response in the filter circuits is brought about by the desirability of having the evidence of energy which appears on the seismograph record be directly attributable to changes in the energy which is related to the substrata in which the geophysicist is interested and not to spurious responses introduced by the filtering system.

As was previously mentioned, modern seismograph equipment in some instances provides as many as eight low-pass filter cut-off frequencies and as many as six high-pass cut-off frequencies. Furthermore, the slope of the high-pass filter's attenuation curve may be varied by means of a separate control. As many as three to five different slopes may be provided.

From the foregoing, it may be seen that more than 100 different usable filter combinations are obtainable in such a geophysical amplifier. The added versatility of such equipment is evident when one realizes that some of the earlier seismograph equipment had as few as three high and low-pass filter settings and no change in response curve slope.

Modern automatic gain control circuits show the same general trend of improvement. With a relatively simple circuit employing a small number of component parts, an effective compromise has been made between the conflicting requirements of holding the average output level of the amplifier within bounds, while at the same time allowing evidence of transmitted energy to be readily apparent on the record, both from the amplitude and phase-change point of view. These circuits are capable of keeping the average output level from varying by more than a ratio of two to one when the input level is changed by as much as the ratio of 32,000 to one. Additionally, certain easily-made adjustments in the performance of the automatic gain control circuit have been made available to the seismograph operator so that changes in energy level and reflection character which occur in different geological areas of the world may be accommodated and optimum record quality obtained.

As was mentioned previously, one of the most notable changes in the various units which make up a complete set of geophysical equipment is seen in the changes in galvanometer design which have occurred over the years. Not too many years ago, the feeling was prevalent that a galvanometer should have an undamped natural frequency which was low enough to allow appreciable attenuation of such extraneous noise as normally evidenced itself in the higher end of the geophysical frequency spectrum. Here again, as with geophones, the general reasoning was sound, but there arose occasions when useful information was of a high frequency and the galvanometer attenuated the signals to such a degree that their amplitude was severely reduced. With this thought in mind present-day geophysical galvanometers have been designed with undamped natural frequencies of around 200 cps. This can be compared with some of the older galvanometer designs which had undamped natural frequencies of around 60 cps. Here again the saving feature is the versatility of the filters used in the amplifiers. If undesirable high-frequency noise, such as that caused by wind, is evident, the low-pass filters in the amplifier may be adjusted so as to permit the maximum amount of usable frequency to pass through the amplifier while at the same time cutting out the undesirable higher frequencies caused by wind or other phenomena. Furthermore, as we have seen, these galvanometers are much reduced in size over earlier units, permitting a larger number of these galvanometers to be accommodated in a much smaller oscillograph than previously. Moreover, the sensitivity of the smaller galvanometer is very much higher than that of the older style unit. This means that less amplification is required in the amplifier; therefore, a smaller number of tubes is necessary and a consequent reduction in size is brought about.

In summation it may be said that while the emphasis in geophysical design during recent years has been on size reduction and circuit efficiency, no sacrifice in usefulness has resulted; instead the versatility of the equipment is now several times greater than that which existed in the older equipment.

Although it is difficult to tie the end results of geophysical prospecting to the several specific design changes which have been discussed, it can be said that geophysical equipment today is doing a far better job under more difficult operating conditions that did the equipment of several years ago. This is evidenced by the fact that many areas of the country which were unsuccessfully surveyed using earlier geophysical techniques are now being explored with modern seismograph equipment. In many instances sufficiently good information has been obtained to allow mapping of the areas, and a significant amount of oil production is being realized from some of them.

All of the credit for this advance cannot, of course, be attributed to improved equipment. Computational techniques have been improved as have many other facets of the oil business; however, it can be said that improved equipment has contributed its share to the advancement of the industry.

By Joseph Huttlinger

WASHINGTON DATELINE

GOVERNMENT SEES NEED FOR MORE DRILLING

OFFICIALS OF THE Petroleum Administration for Defense, who naturally view the oil situation primarily from the angle of national security, have estimated on the basis of a wholly unofficial survey that approximately 55,000 oil wells will be drilled in the world during 1953, exclusive of Soviet controlled regions. Of the estimated total, about 47,000 are expected to be put down in the United States, 2,680 in Canada, and 5,095 in other parts of the world.

If this program actually is achieved, it will set another high record in oil well drilling. The 1952 total was about 52,000 new oil wells in the United States and abroad. In tabular form, the past and current drilling record presents itself about as follows according to this calculation:

	1951	1952	1953
United States	44,516	45,840	47,000
Canada	1,544	1,846	2,680
Others	3,379	4,330	5,095
Total	49,439	52,016	54,775

These figures by no means represent PAD's opinion of what is needed to build up a crude oil capacity adequate to the demands of a possible emergency. They are based on reported plans of oil companies and independent operators. J. Ed. Warren, deputy petroleum administrator, has named a four-man committee to double check. The committee is made up of Richard Gonzales, Humble Oil and Refining Co.; Minor S. Jameson, assistant to the president, Independent Petroleum Association of America; Henry McAuliffe, Socony Vacuum Oil Co.; and Paul R. Schultz Jr., Stanolind Oil and Gas Co. It is to report on just what may be expected from the industry in the way of new oil wells in America this year.

The figures stated are regarded as reasonable, but of course any advance estimate is subject to fluctuations due to changes in industry conditions. A rise in the price of crude, a stepped-up demand or a slow-down in imports might stimulate drilling in the United States, it is pointed out. Overseas, a series of factors, including increased supplies of steel, might spur more activity. Walter Keefe, director of the foreign production division, names Turkey, Yugoslavia, Brazil, Peru and Argentina among countries which might see more drilling than presently planned. In Canada, a total of 3,000 new wells could be sunk if oil well steel was available in greater quantity, he said. On the other hand, a series of depressing factors could limit foreign drilling. One possible factor that does not seem imminent is a settlement of the Iranian dispute that would start Iranian oil moving into world channels.

In contrast to the actual plans of petroleum companies is the view of the petroleum agency on just how many wells are needed this year. Both the industry and the defense agency agree that a record number of wells is needed merely to keep up with demand and maintain a normal reserve. After that, the two part company. The defense agency wants extra drilling to get a larger reserve against the demands of full scale war or other possible emergency.

In short, PAD wants more wells than the industry plans to drill; it wants more than the supply of oil country tubular goods from regular mill production will support; and it wants more than it feels the industry, particularly the domestic industry, can support on a sound, economic basis under present price-cost and supply-demand conditions.

Exactly how many wells PAD would like to see drilled this year it has not said recently. Officially, the agency stands by its year-old, 18-month oil expansion program. This was designed to get a "minimum" of reserve against the demands of war and peace. For this year, the program proposed 61,752 new wells. Of these, 55,000 were suggested for the United States; 2,680 for Canada; and 4,072 elsewhere abroad, plus an estimated 1,168 wells not included in the PAD schedule.

While the 18-month program is undergoing some revision, it is significant that only the Canadian figure appears to be up to the program. Both the United States and other outside areas seem destined to fall short of the original goals.

Just why United States oil men are expected to drill fewer wells than the original blueprint called for is answered chiefly by normal economic reasons. As PAD realizes, some American oil producers are losing their enthusiasm to drill because of rising costs of drilling, the build up of a larger reserve of unused capacity, the threat of over-production for normal demand, and rising oil imports which are averaging more than a million barrels daily. At the same time, the price of crude, as price controls come to an end, is at the level of five years ago. With a further rise in available supply above normal requirements, drillers face a longer payout period for new wells drilled at still mounting costs.

The supply of oil country tubular goods is expected to be larger this year, but not large enough for a great expansion in drilling. If oil men are to go above 47,000 new oil wells, they will need to use high-cost conversion steel and to import expensive foreign pipe. Without strong incentives, they may be unable to afford this.

An estimate of probable production and consumption in the United States for 1953 was given by Charles J. Hedlund, director of the program division of the Petroleum Administration for Defense, in an address before representatives of farm cooperatives in January. Mr. Hedlund anticipated a rise in domestic demand of 5.7 percent with the greatest increase in distillate fuel and the smallest in residuals. His estimate appears in the accompanying table.

UNITED STATES PETROLEUM FORECAST

	Year 1952 Thousands Barrels Daily	Year 1952 % Increase Over Prev. Year	Year 1953 Thousands Barrels Daily	Year 1953 % Increase Over Prev. Year
DEMAND				
Domestic Demand				
Gasoline	3,146	+5.5	3,305	+5.1
Kerosine	341	+.9	358	+5.0
Distillate	1,318	+7.6	1,460	+10.8
Residual	1,514	−2.0	1,560	+3.0
Other	959	+1.7	1,010	+5.3
Total Domestic	7,278	+3.5	7,693	+5.7
Export	426	+.7	338	−20.7
Total Demand	7,704	+3.3	8,031	+4.2
SUPPLY				
Imports—Crude	570		620	
Products	381		400	
Total	951		1,020	
Crude Production	6,262		6,401	
Nat. Gas Liquids	604		645	
Total Supply	7,817		8,066	
Stock Change	113		35	
Crude Runs	6,667		6,925	
Capacity	7,565		7,970	
% Operated	88.1		87.0	

It was pointed out by Mr. Hedlund that the current scale of industry operations would be about sufficient to cover domes-

(Please turn to page 119)

A resume of an extemporaneous paper presented to the Oklahoma Section of the Petroleum Branch of the American Institute of Mining and Metallurgical Engineers at Ponca City, Oklahoma, November 17, 1952.

Prospects for improving oil recovery

By Paul D. Torrey

Paul D. Torrey is recognized as the leading authority on methods of increasing the recovery of petroleum from its native reservoirs. For 13 years he has been chairman of the standing sub-committee of the American Petroleum Institute on secondary recovery methods and serves in a similar capacity on corresponding committees of the Interstate Oil Compact Commission and the Independent Petroleum Association of America. He also has been a contributor to the United Nations Scientific Conference on the Conservation and Utilization of Resources. In February, 1952, he received a citation from Marietta College conferring the degree of Doctor of Science. Mr. Torrey is president of Orchem Corporation, an organization engaged in the development of chemical processes to increase the efficiency of oil recovery.

A CONSIDERATION of the factors which control the movement of fluids through the openings of oil reservoirs indicates most impressively that most of them are not susceptible to alteration that would serve to benefit or to accelerate the rate of oil recovery.

This statement, of course, is subject at once to some qualification, for it is possible to alter to some extent the radius of well bores by various mechanical processes or to reduce the radius of the drainage area by the drilling of additional wells. Such changes, however, may be made in many cases only with some difficulty and, very likely, at considerable expense. Consequently, they may not be at all practical or economic. Obviously, geometric and logarithmic functions, as well as the thickness of the oil-bearing rock, are not subject to change, and long experience has shown that there is a very definite limitation to the differential in pressure that may be created in the reservoir. Thus, it is evident that reduction in reservoir crude viscosity or increase in the permeability of the reservoir rock to oil or to water, whichever may be desired, are the most promising possibilities for improving the efficiency of oil recovery.

Reservoir crude viscosity can be reduced by the application of heat, by dilution with light hydrocarbon liquids, and by the solution of light hydrocarbon gases. Increase in effective permeability to oil or to water may be effected by increasing the preferential wettability of the reservoir surface to the respective liquid phases. An increase in permeability to water may also take place by a reduction in the interfacial tension between oil and water which, in turn, tends to reduce the capillary pressure existing in the more minute pore passages.

The possibility of increasing oil recovery by the application of heat energy to the reservoir has been recognized for a number of years, and attempts have been made in almost every important oil producing region to apply some form of heating process. Recently consideration has been given to the heating of reservoir fluids by electric current—the process of pyrovolatilization—by hot gases, and by hot water.

Pyrovolatilization is a process of underground vaporization, proposed recently by Slezak and Davis[1] for application in the Bradford field, in which the reservoir is first fractured by high voltage electricity and its temperature then increased to the point where the oil in the porous rock immediately surrounding an input well will ignite spontaneously when compressed air is injected into it. It is conjectured, quite reasonably, that the water occurring in the reservoir will be converted to steam, and that recovery of oil will be obtained as a result of a steam distillation process. As the process is continued, it is believed

that vaporization of both oil and water can be controlled by maintaining back pressure at the producing wells. The total pressure that can be developed in the reservoir will be fixed by the vapor pressures of water and oil at any specified temperature. Thus, the pressure will decline from the higher to the lower temperature zones. It is proposed to raise the temperature of the Bradford sand initially to an average value of 400°F by means of electricity, and thereafter by the burning of some of the oil in the reservoir. The vapor pressures of oil and water at this temperature are about 100 psi and 250 psi respectively, so it will be necessary to inject compressed air into the sand at a somewhat higher pressure.

The authors estimate that about one-third of the oil in the reservoir will be consumed to provide the necessary heat.

The movement of fluids through the Bradford sand at the vapor pressures created by an increase in temperature to 400°F will be slow on account of its low average permeability. Consequently, it would seem that there should be greater opportunities for the economic application of the process of pyrovolatilization to other more shallow and much more permeable reservoirs of western Pennsylvania. Many of the shallow Venango sand reservoirs have responded successfully to pressure differentials in the range of 100 to 250 psi in artificial gas drive.

In 1927, A. F. Melcher, research physicist with Marland Oil Company (now Continental Oil Company) attempted to increase oil recovery by heating a very shallow oil sand, which was found at a depth of around 20 feet, with hot exhaust gases produced from the cracking stills of the nearby Ponca City refinery. Large diameter holes were drilled for the injection of the hot gas in order that a man could be lowered to the level of the oil sand, after the hole had been cooled, to inspect the effects of the application of heat. Temperatures of around 700°F were applied to the reservoir, and in a matter of a very few months no more hot gas could be injected, but during this period some increase in oil recovery was noted in four offset producing wells located in a square pattern 50 feet away from the input well. Subsequent inspection of the oil sand in the input well revealed that the pores had been plugged by the deposition of carbon and asphaltic material, and possibly by some fusion of soft clay cement.

Subsequently, Russian authors[2] have reported on experiments conducted in the Grozny field where hot exhaust gases were produced at the bottom of wells by the burning of natural gas under pressure when mixed with the correct proportion of air. Moderate increases in oil production were reported, but the performance of the wells, as described by the authors, certainly indicates plugging of the sand, presumably from the deposition of carbon and quite possibly from vitrification, either of which would reduce greatly any temporary benefits resulting from the application of heat energy to the reservoir by the injection of hot gas.

The results of these two field tests, under widely different conditions and in widely separated areas, are very similar. They point to a generalized conclusion that application of hot gases, at the high temperatures necessary to affect the entire volume of the reservoir, will rarely be practical because of the cracking of the oil and deposition of carbon, and because of the distinct possibility that vitrification of the reservoir will take place.

Recently, Frederick Squires and Edmund S. Merriam[3] have described a submerged burner for the underground generation of heat, which avoids the application of excessively high temperatures to the face of the reservoir in an input well by the production of steam right at the bottom of the well. The steam so produced will take on additional heat liberated by the burner. The resulting mixture of steam with the products of combustion will hold the heat generated by the burner largely as latent heat. Thus, heat losses in a vertical direction are minimized since most of the heat is carried into the formation as latent heat rather than as sensible heat.

The underground burner is submerged in water near the bottom of an input well. Fuel oil and air, or gas and air, are piped to it from the surface in the correct proportions, and are ignited and burned. The hot exhaust gases are conducted below the surface of the water where they are released to generate steam. The mixture of exhaust gas and water vapor may have a temperature initially below the boiling point of water. It will deposit liquid water when its dew point is reached as it cools while passing through the reservoir. The condensing steam liberates its heat, but, of course, it does not do this all at one point. Some water vapor is retained in the mixture and is deposited only as the dew points are reached for mixtures carrying less and less steam with increasing distance from the input well.

The Squires-Merriam underground burner has been employed successfully in a small scale field trial, but in this test it is doubted whether it would have been commercially successful because of high cost of fuel. The principal problem, therefore, in the economic application of heat to increase oil recovery is to get sufficient heat into the reservoir at minor cost. A fascinating possible solution to this problem has been proposed by Frederick Squires[4], based on his studies of the experimental underground coal gasification project of the Alabama Power Company and the United States Bureau of Mines at Gorgas, Alabama, where 10,000,000 cubic feet of exhaust gas, at a temperature of 1,700°F, have been produced daily. In this operation it has been demonstrated that the volume of gas at the high temperature can be produced almost indefinitely. It has also been shown that the hot gas will move through permeable sandstones above the burning coal bed, and that it can be brought to the surface through open holes. It is immediately apparent that if this hot gas could be conducted to the bottom of input wells rather than being brought to the surface, which is a problem that should certainly be susceptible to rather easy solution, the process of injecting a mixture of steam and exhaust gases, as proposed by Squires and Merriam[3], could be applied much more economically since hydrocarbon gases or liquids would not be required for the generation of heat. Squires and the writer have emphasized that many of the shallow oil-producing areas of the United States are located where deposits of coal are in close proximity to the oil reservoirs. Many of the coal beds are so thin or are of such inferior quality that they cannot be produced profitably for above-ground fuel supplies. Nevertheless, there is no reason why they could not be ignited and caused to produce hot exhaust gases which could be used in oil recovery processes.

In somewhat similar manner, the heat developed in the generation of carbon dioxide for the Orco process could be used to increase the temperature of the carbonated water. Although heating of the water at the surface would not be as effective as undergound heating, the loss from radiation as the warm water moves from surface to reservoir should not be too great at moderate temperatures.

Recalling the familiar technique in which samples of oil reservoir rocks are cleaned for various laboratory tests by solvent action, it could be expected that a high degree of recovery of oil might be obtained by the injection of light liquid hydrocarbons into oil reservoirs. Dilution of a heavy crude oil with light hydrocarbons will reduce viscosity in addition to the benefit that should be obtained from the scrubbing of the reservoir surface by a solvent. The solvent could be injected into the reservoir either in the form of a liquid or condensable gases.

At the Fourth Texas Petroleum Recovery Conference, H. T. Kennedy[5] proposed a method whereby substantial increase in oil recovery could be obtained in connection with the storage of liquifiable petroleum gases, commonly known as "LPG." It was pointed out in his paper that the seasonal nature of demand for LPG and the fact that they are frequently by-products of natural gasoline manufacture, often makes unusually large storage capacity necessary. Depleted gas-drive reservoirs represent one good possibility

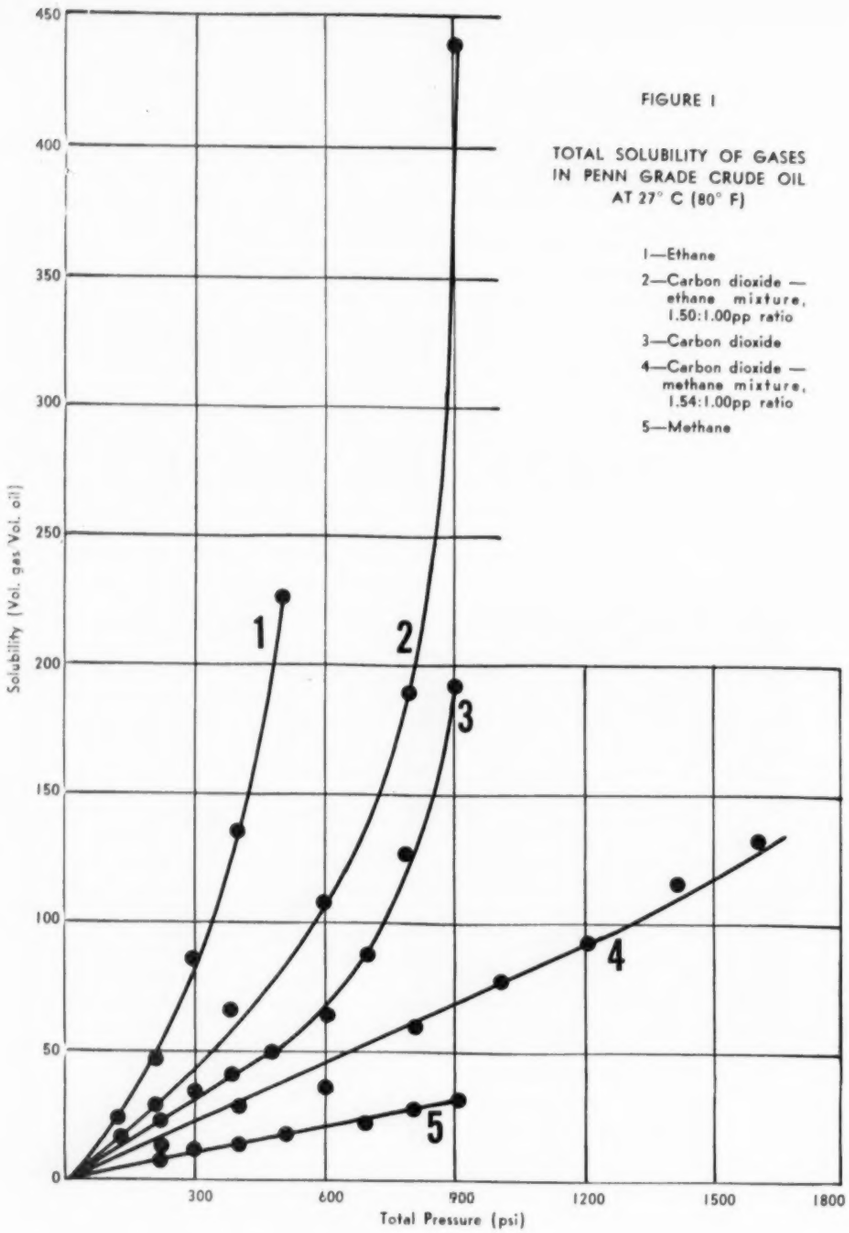


FIGURE 1

TOTAL SOLUBILITY OF GASES IN PENN GRADE CRUDE OIL AT 27° C (80° F)

1—Ethane
2—Carbon dioxide — ethane mixture, 1.50:1.00pp ratio
3—Carbon dioxide
4—Carbon dioxide — methane mixture, 1.54:1.00pp ratio
5—Methane

for storage purposes, and at moderate depths, assuming that all wells are tight, or if abandoned are properly plugged, such reservoirs are adequate to withstand any required pressure. In order to obtain the benefit that can be expected from the injection of LPG, the oil reservoir must have fairly pronounced structural relief and high permeability in order to facilitate gravitational segregation of reservoir fluids. It is also essential that wells be completed at both high and low structural positions. The wells located at high structural position will be used for the injection of LPG and the wells located at low structural position will be used to produce diluted crude with lowered viscosity. Laboratory experiments have indicated the possibility for a higher recovery of oil by the injection of LPG at high structural position than is obtainable by any other recovery process. In actual practice the percentage recoveries indicated by laboratory work probably will not be obtained, but the writer[6] has described projects in California and in Iran where substantial increases in oil recovery have been indicated by the dilution of fairly heavy crude oils by light hydrocarbon liquids.

The limiting factor to LPG injection by the Kennedy method is the necessity for pronounced structural relief in the reservoir. A dip of at least 10° from the axis of the structure is considered to be essential, and theoretically the efficiency of the recovery process increases in structures with more acute dips. The steeply dipping anticlines, which have controlled the accumulation of oil in many of the fields of California and Iran, obviously are ideal for the LPG injection process.

Laboratory and field experiments have indicated that the injection of light hydrocarbon gases prior to water-flooding and high pressure gas injection under certain specific conditions result in substantial increase in oil recovery over the amount that could be obtained by unaided primary recovery from gas-drive reservoirs.

As reported independently by Schiffman and Breston[7] and by Holmgren and Morse[8], an increase in gas saturation in the reservoir rock prior to the injection of water in laboratory tests has resulted in an increase in oil recovery of up to 50 percent above that which would have been obtained by the use of water alone. It is believed that the beneficial results observed in laboratory experiments of gas injection prior to water flooding are due to several factors, among which can be cited:

(a.) an increase in mobility brought about by changes in relative permeability values, and by a reduction in the viscosity of the reservoir crude oil.

(b.) increased formation volume factor resulting from the swelling of the reservoir crude oil by solution of gas.

(c). increase in temperature by release of latent heat of vaporization as gas is dissolved in crude oil.

(d.) the selective filling of the more permeable sections of the reservoir with gas bubbles (the Jamin effect) ahead of the water, thus reducing the tendency of the water to bypass through zones of higher permeability.

As reported by the writer[9], field experiments over a period of several years by the South Penn Oil Company in the Bradford field have tended to confirm the results of the laboratory work even though the prior injection of gas was employed originally as a fuel conservation measure. However, fairly limited experience with gas injection prior to water-flooding in shallow Oklahoma fields producing from the Bartlesville sand has been quite negative. Little or no increase in oil recovery, above the amount that could be expected from conventional water flooding, has resulted from prior injection of gas.

In 1944 Frederick Squires[10] first proposed secondary recovery by simultaneous injection of gas in the central part of a field possessing low structural relief, and the injection of water around the edge. He also proposed an ideal method of pressure maintenance for fields located on well defined anticlinal structures in which gas is injected in wells located at the highest part of the structure and water is injected contemporaneously slightly below or at the existing water-oil contact. The method proposed by Squires first received a field test, as far as is known, in the West Tepetate field, Louisiana, by the

(Please turn to page 104)

Peru auctions concessions

By Juan E. Rassmuss

ONE OF THE PROVISIONS of the new Peruvian petroleum law specifies that when the areas for which exploration permits are applied for overlap one another, final decision for awarding these shall be determined by public auction, the award going to the highest bidder. The first such auction was held in Lima from January 19 to 23.

The auction brought out some spirited competition with 11 bidders participating. It was a profitable affair for the government, which realized a total of 38,346,531 soles or about $2,500,000 in premiums on leases to 486,029 hectares (1,200,000 acres) the overprice being in addition to the regular lease charges established by law. It may be mentioned that these leases are located in a completely unproven area where no drilling has been done.

The highest prices paid were 400 soles per hectare or around 11 dollars per acre for an exploitation concession taken by the Argentine Compania Sud-Americana de Petroleo. Conorada Corporation paid 360 soles per hectare or about 10 dollars per acre for another concession of 4,000 ha. For exploration concessions the highest bid was 350 soles per hectare, or almost 10 dollars per acre, paid by Richmond Petroleum Company.

During the five days a total of 109 overlaps were auctioned. The first allotment went to International Petroleum Company for 160 soles per hectare. The final results were the following:

International Petroleum Company paid for 34 concessions, comprising 97,342 ha. or around 240,000 acres, the sum of 10.7 million soles or around $700,000.

Richmond Petroleum Company (Standard of California) acquired 10 concessions of 63,449 ha. or 157,000 acres for 9.3 million soles ($600,000 U. S.).

Sea Oil Ltd. (Canadian) took 19 concessions totalling 104,091 ha. or 250,000 acres for 8.16 million soles.

Peruvian Gulf Oil Company (Gulf Oil Corp.) took 19 concessions aggregating 74,918 ha. (185,000 acres) for 5.87 million soles.

Conorada Corporation was assigned concessions totalling 29,934 ha. for 1.75 million soles.

Cia. Sud-Americana de Petroleo took three concessions totalling 11,505 ha. for 1,127 million soles.

Peruvian Oil & Minerals Ltd. (Canadian) took three concessions totalling 12,752 ha. for 242,000 soles and Peruvian Oil Concessions Inc. two concessions of 3,500 ha. for 92,000 soles.

Of the three participating national companies, Cia. Petrolera Peruana acquired seven concessions of 37,340 ha. for 471,940 soles; A. & F. Wiese received one concession of 7,000 ha. for 420,000 soles; and Cia. El Oriente, seven concessions of 44,164 ha. for 231,000 soles.

In the Montana, the Amazon basin, only a few overlaps between the national Cia. El Oriente and Canadian Oil & Minerals Ltd. were auctioned, but the prices were very low, amounting to 50-60 centavos or around 4 cents U. S. per hectare.

The proceeds of the auction reportedly will be employed by the government for irrigation works.

The auction has proved anew the keen interest in oil prospects of Sechura in Peru. At present about 90 percent of the oil imports of the free world proceed from only four countries, of which only Venezuela is located in the western hemisphere, and it is considered desirable for security reasons to increase available supplies in this part of the world.

For the Peruvian Montana, east of the Andes, no definite projects have been planned so far, but it is reported that Ganso Azul field has been acquired by a Texas oil company and is expected to be developed on a larger scale. Besides, several major companies are reported to be considering a joint operation for exploring the Montana prospects.

An interesting point in the recent sale is the granting of a concession to A. & F. Wiese. According to information here this company is acting for Union Oil Company. This firm is a large Peruvian commercial and banking organization which had applied for around 250,000 acres of exploration concessions in the northern part of the Sechura desert and constituted for this purpose a new company, Sullana S.A., with a capital of five million soles (about 330,000 dollars).

According to the new Peruvian petroleum law, 40 percent of the shares of a national company can be held by foreign shareholders and it is assumed that this interest will be taken over by Union Oil Company. It is understood that the latter company will operate the oil development.

APPLICATIONS UNDER PETROLEUM LAW

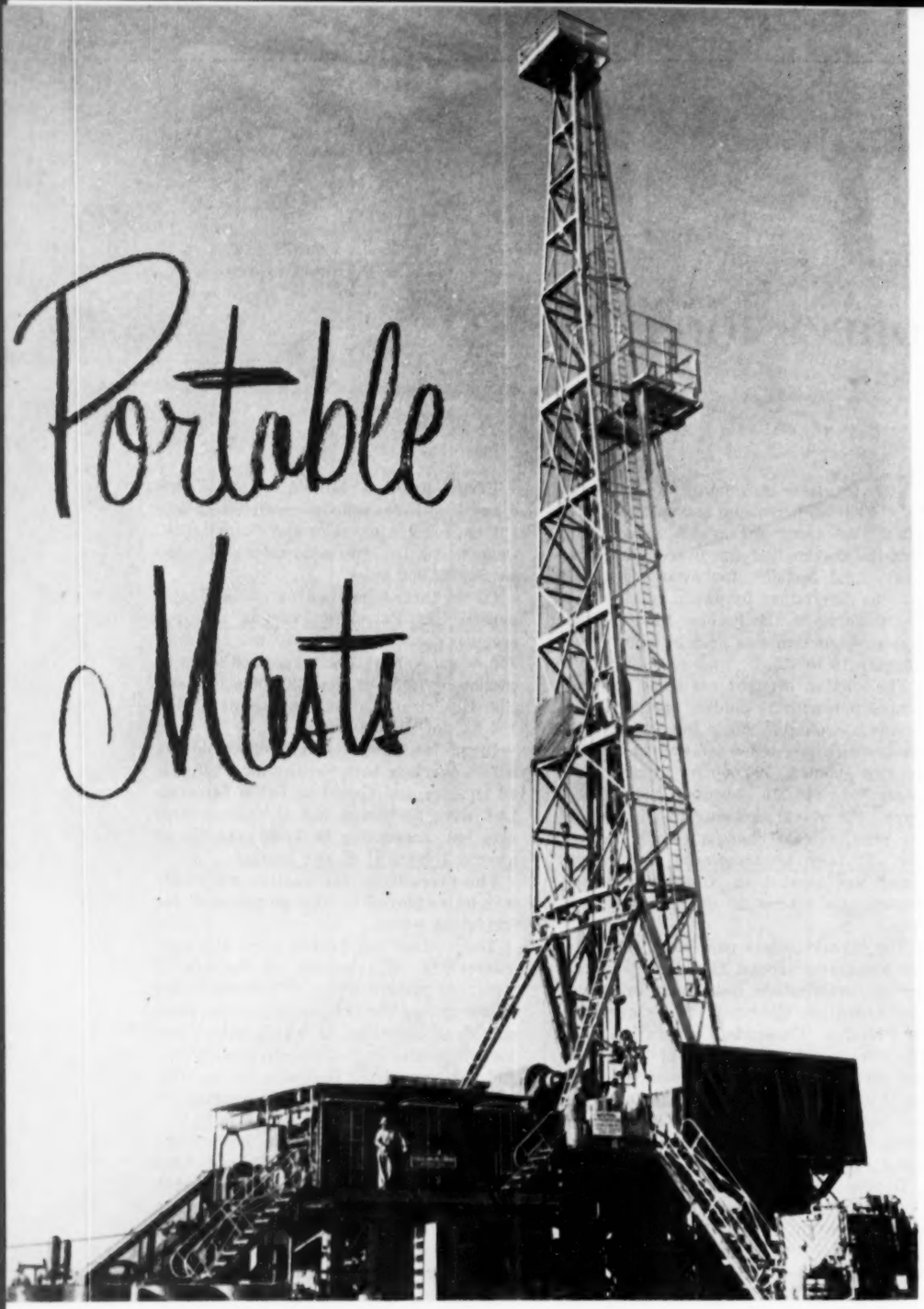
Company	COASTAL ZONE (Has.)* Exploration	Exploitation
Cia. Peruana de Petroleo "El Oriente" S.A.	117,600.00	———
Cia. Sudamericana de Petroleo S.A.	———	53,407.65
Consorcio Minero del Peru	10,000.00	———
Conorada Petroleum Corp.	350,900.00	49,000.00
International Petroleum Co. Ltd.	377,392.17	99,999.83
Peruvian Gulf Oil Company	428,843.43	———
Peruvian Oil Concessions	———	43,149.79
Peruvian Oils & Minerals Ltd.	49,140.00	7,814.99
Petrolera Peruana S.A.	398,169.93	———
Petrolera San Miguel S.A.	10,419.46	———
Richmond Oil Company	300,000.00	100,000.00
Seaoil Limited	297,585.48	99,999.83
A. and F. Weise	134,365.73	———
	2,474,416.20	453,372.09

Note: The International Petroleum Co., Ltd. and the Peruvian Gulf Oil Co. before requesting the areas shown in this table relinquished 79,817.90 and 42,912.00 Has., respectively.

	EASTERN ZONE	
Cia. Peruana de Petroleo "El Oriente" S.A.	767,445.60	———
Cia. de Petroleo Ganso Azul Ltda.	104,316.00	———
Peruvian Oils & Minerals Ltd.	364,332.00	42,250.00
	1,236,093.60	42,250.00

*Has. (hectares)—1 ha.=2.471 acres

Portable Masts



Below, portable well servicing mast of the unguyed type. Except as otherwise noted all photographs with this article are reproduced through the courtesy of the Lee C. Moore Corp.

Nickols Drilling Company 142-foot mast with two-level substructure. This large mast has a capacity of 860,000 pounds and is capable of drilling below 15,000 feet.

Two views of the substructure of a 96-foot mast of a type generally used in shallow drilling.

A REVOLUTION IN THE DESIGN of drilling derricks employed by the oil industry has taken place in the post-war period.

Just before the outbreak of the war, the first cantilever type portable drilling mast was developed by the Lee C. Moore Corporation. Today about 2,600 of the 2,800 active drilling rigs in the mid-continent are operating under portable masts. Now several derrick manufacturers have masts to offer the industry.

In foreign operations, drilling masts have not taken over 93 percent of the rigs as is the case in the United States. There is, however, a strong trend toward masts for drilling abroad, particularly in areas where the terrain is favorable for movement from location to location as on the desert and in plains country.

Reasons for the revolution in derricks may be found primarily in the shortage of skilled labor and the higher cost of labor. Of possibly equal importance is the necessity for keeping drilling costs down by moving rigs from location to location quickly so that equipment as well as manpower will be more fully utilized.

Portability of the mast is greater than that of the standard derrick whether the move is to be by skidding from location to location, or whether the derrick must be dismantled for highway transportation to a more distant location. Location-to-location skidding of masts in an erect position is feasible over rougher terrain than is possible with standard derricks. For more distant off-the-road moves, the mast may be lowered and moved by truck and trailer. Over-the-road moves within highway regulations may be made by quickly breaking masts into units which are easily reassembled at the new location.

One of the first masts built was put into service in Illinois. The operators there found that they could dismantle the rig, move to a new location, set up and drill 700 feet within a 24-hour period. Under a standard rig, such speed could be attained only where rig builders were working ahead of the drilling crew and using a spare derrick for the purpose.

In periods of adverse weather and acute labor shortage, there have been instances in which it was possible to move in a mast, drill and complete a well before a standard derrick could have been erected and made ready for drilling to begin. In shallow Kansas fields, it generally is possible to move from one location to the next and start drilling in about six hours.

The portable mast as first developed was designed exclusively for shallow work. The first Lee C. Moore mast which went into service prior to World War II was an 84-foot structure largely used in drilling 3,500-foot holes. Since that time the masts designed by this company and others have been increased in height and capacity so that today it is feasible to drill to 15,000 feet and deeper. Several years ago a heavy duty model of the Moore mast was used to a depth of almost 14,000 feet in California.

The early 84, which was soon changed to an 87, had a gross nominal capacity of 300,000 pounds. This was followed with a 94 and a 126-foot mast with a capacity of 415,000 pounds. These two masts were the same except for the added height, to allow the handling of trebles instead of doubles. This was attained by providing an extra section which could be used or not as desired.

More recently the equipment industry has developed 129, 136, and 142-foot masts. The newest and largest mast now has a capacity equivalent to an API derrick rating of one million pounds and is capable of depths beyond 15,000 feet. The newest large masts have a drill pipe stacking capacity of 15,660 feet of 4½-inch OD pipe. Inside dimensions of the original 87-foot mast were sufficient to allow for the stacking of 4,800 feet of 4½-inch pipe.

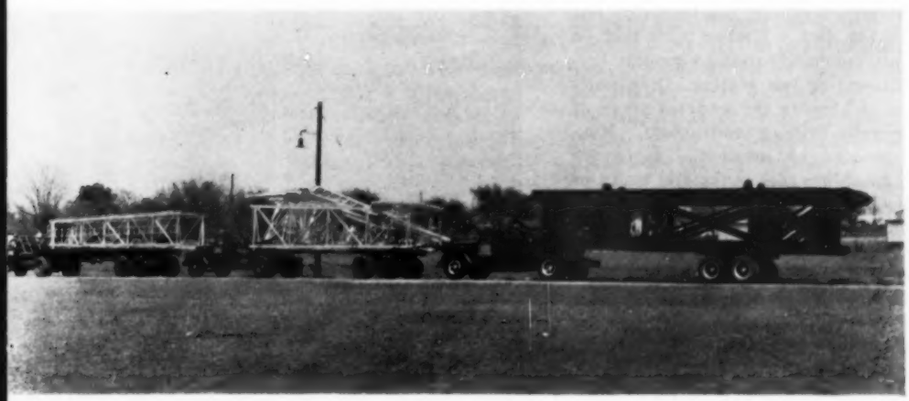
An interesting recent application of the mast type derrick has been in coastal waters of Texas and Louisiana. Drilling contractors and oil companies have built barges mounted with masts capable of drilling 8,000 to 15,000 feet. Standard rotary rigs have been mounted on barges for a number of years and in open water can be moved readily from location to location without dismantling. Recently some operators have mounted cantilever type masts in order that barges may pass under high lines or fixed bridges on coastal waterways or through passages where overhang presents difficulties.

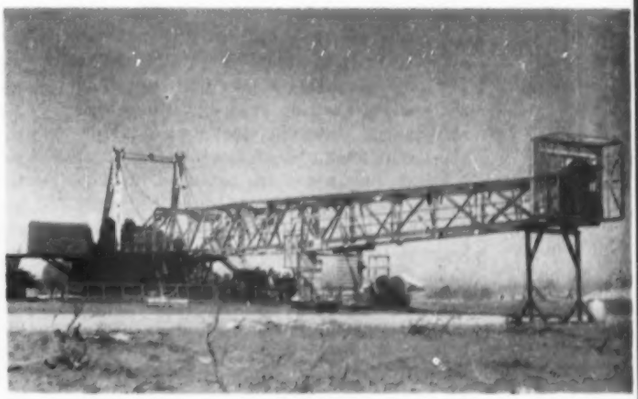
An oil company barge in the Corpus Christi region which cost about $700,000 to build is mounted with a 142-foot cantilever mast. It is equipped with six 200-hp diesel engines for drilling to 13,000 feet.

A drilling company operating in Louisiana coastal waters has equipped a submersible barge with a 127-foot mast. Displaying the type of ingenuity which contractors often have, one driller on the Gulf Coast has kept his capital costs low by adapting an 8,000-barrel oil barge as a base for a jackknife rig.

Usually it is on land that the mast is most useful in promoting speed in moving to a new location. Derrick manufacturers have contributed to the speed in their design and contractors have perhaps contributed even more in the methods they

A portable mast and substructure trailer mounted for highway transportation is shown at left, and at right, a mast on location ready to be raised to drilling position.





Full View mast developed by IDECO division of Dresser Equipment Company. This mast is made in three heights ranging from 133 to 143 feet with stated capacities from 360,000 to 600,000 pounds. The 143-foot mast has a capacity equivalent to one million pounds API and is suitable for drilling below 15,000 feet.

have used in unitizing their rigs for fast moves. Elements of early mast models were joined together with machine bolts and lock washers. Manufacturers now supply drive pins for quick assembly.

Design of the substructure units has been improved for faster moving of rigs by Athey wagons and tractor wheels through the inclusion of windows for the insertion of cross beams. Often it is possible to move the entire rig without dismantling except breaking connections in fuel and mud lines. Such moves have been made over considerable distances in extremely rolling country. Although the masts may look top heavy this is not, in fact, the case. Masts have been moved in the upright position over such rough terrain that at times the mast stem would be leaning at some 20 to 25 degrees from true vertical. Guy wires are not used in moving. Some masts have drilled continuously for about two years without ever being lowered to the horizontal position.

In moving mast rigs, first step is to jack up the structure so that it will clear the Christmas tree of the completed well. Beams then are run through the substructure so that they extend out a few feet on each side. Each is bolted in place. Crawler type track wheels are placed under the beams. Two front units are swiveled to permit turning and the rear units are locked in place. Relatively sharp turns can be made. Drawn by tractors, the heavy rigs can pass over wet and sandy terrain that would bog down a truck. Speed of movement from location to location averages about three to four miles per hour.

Although relatively light in weight, the masts are tough enough to stand the necessarily rugged usage to which they are put in the field. The first portable cantilever mast built still is in regular service after 12 years.

Several general types of free-standing masts have been developed by manufacturers.

Dresser's IDECO mast, a twin tower with load bearing raising legs, is quite different from others. It consists of two large columns spread 24 feet apart at the base. They are braced together with the racking platform and two back-strut beams into a rigid "A" frame. The mast can be transported in truck-width sections.

The Moore cantilever mast is an open front tower with an A-frame gin pole extending to the rear. Pipe is racked in front. Legs are spliced with drive pins and nesting of tower components facilitates truck movement when dismantling is required.

Three general types of substructure are built for masts. One is designed with a single level consisting of twin boxes with cross spacers. A second is similar except that it provides a lower level for the engines of rigs having set-down drives. The third general type provides for setting the hoist at a level about four to five feet below the working floor area or at about the same elevation as the former group. The advantage of this is that the installation of the hoist on the sub-structure is speeded up. Floor extension brackets are provided to increase floor area. Split bases permit movement of truck-length units where skidding is not possible. The units are connected with drive pins at location.

Highway trucking limitations have generally fixed the height of substructure units at nine feet and the width of box units at 7½ feet. Timber mats laid on gravel are commonly used to support bottom stringers or box plating. Box units are used as housing for a varied array of equipment by drilling contractors. Moving is speeded by using the space for tool rooms, bins, fuel tanks and units of mud, water and fuel lines. Unitization of rigs for quick moves has been developed to a high degree by cost conscious contractors in recent years.

Where moving conditions dictate that drilling masts be laid down and carried considerable distances by truck, the derricks usually are broken up into sections. The 96-foot mast is usually carried on two trucks while the 133 and 142-foot masts are moved in seven sections. Six trucks and trailers are needed for loading the largest masts.

In addition to the free-standing unguyed drilling masts, manufacturers have developed a line of truck and trailer mounted masts for light drilling tasks such as seismograph shot holes, structure drilling and in fact, general drilling to 7,500 feet. Well servicing units also have been mounted on trucks for maximum mobility. Truck mounted units are capable of servicing wells as deep as 5,000 feet. Some of these may operate without guys.

Highway restrictions hold well servicing units to an overall length of 60 feet and a width of eight feet. Lightness has been achieved by using high yield strength alloy steels so that the maximum hook capacity can be attained per unit of weight.

Heavy duty trailer-mounted drilling rigs usually have a capacity of about 250,000 pounds and about 7,500 feet of 3½-inch drill pipe can be racked. Units of this general character are rugged, but avoid the all-out beefing-up which has been designed into deep-well rigs. Emphasis is on mobility and speed.

In a recent article in WORLD PETROLEUM (Sept. 1952, p. 64) an account was given of the structure drilling activity of Mene Grande Oil Co. in Venezuela using masts of this general type. In recent years this company has drilled 2,821 holes overaging 1,639 feet in depth. Some of the heavier rigs of this company have averaged making nearly 1,200 feet of hole per working day over a full year. In 1951 one rig drilled 128 holes to an average depth of 2,809 feet. Drilling cost has been below $1.50 per foot.

The great popularity of drilling masts for average drilling work today in rough country as well as on the plains and for coastal waters, is a tribute to the fine engineering which has been put into portable equipment by the manufacturer.

Trailer-mounted drilling rig of the light weight, guyed type suitable for shallow well drilling.

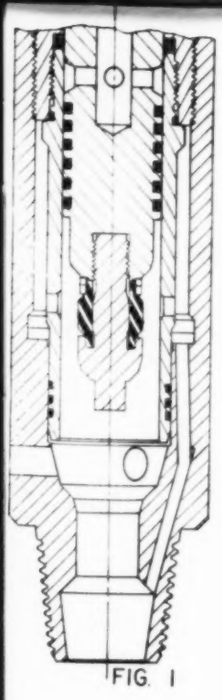


FIG. 1

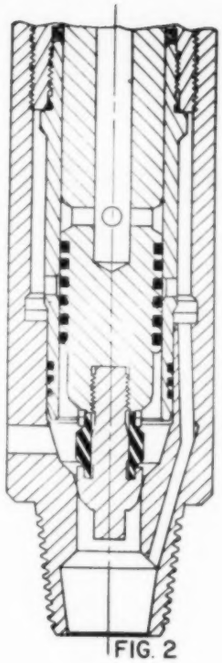


FIG. 2

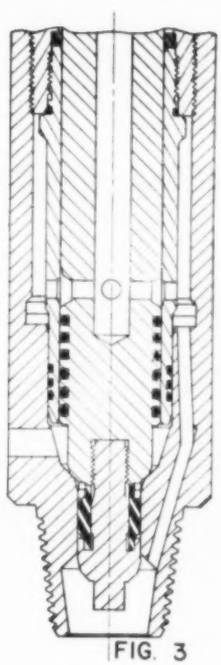


FIG. 3

Fig. 1, left, vertical section of tester at start of time delay after weight has been applied. Fig. 2, end of time delay period to allow packer expansion before opening of tester. Fig. 3, tester is open and full weight of mud is exerted on packer.

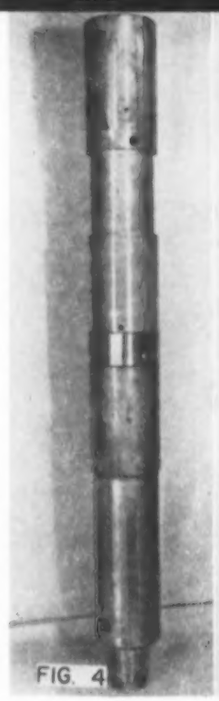


FIG. 4

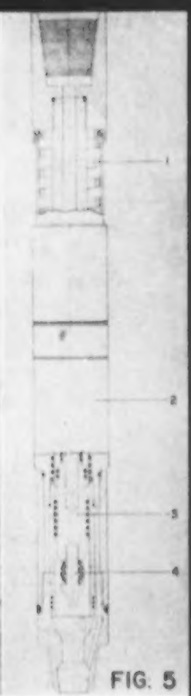


FIG. 5

Fig. 4, right, exterior view of Howco Hydrospring Tester. Fig. 5, section of tester showing (1) closure spring, (2) fluid chamber with two-way valve mechanism, (3) sliding valve to open and close tester, (4) by-pass valve.

New Concept in drill stem testing

By W. A. Wallace*

THE RESULTS of determination continue to produce equipment modern in design and effective in general use. A product of this determination is the newly developed and field tested Howco Hydrospring Tester. The Hydrospring Tester has been in the development stages for approximately 24 months, and was released in June, 1952, for field exploratory tests. Its future was determined immediately, as the results of the added features were greater than expected. Few field tests were necessary to indicate the rapid demand for its use.

The principal elements involved in a formation testing assembly are: (1) the tester or valve mechanism that controls the flow of fluids into the drill pipe above the tool; (2) the packer assembly that isolates the section of the well to be tested from other producing horizons and restricts the flow of drilling mud above the packer into the testing section; and (3) the sub-surface pressure recording device that records all pressure variations from the time of entry in the well until its removal.

Testers generally used in such an assembly require rotation of the drill pipe for disengaging J arrangements or require the dropping of a disc-breaking bar for tool opening. In many cases, the manipulation of these tools present questionable results until the pressure recording device chart is removed from the instrument and pressure changes checked. The development of the Howco Hydrospring Tester complies with many requests for a testing tool that will perform satisfactorily and with ease in all of the varied operations that are necessary for smooth, safe, and constant drill stem testing.

Several designs were considered and many tests were performed, and as a result, the Hydrospring Tester incorporates many new features, which include a locked open by-pass, lateral expansion of the packer before opening tester, only vertical motion of drill pipe or tubing for opening and closing tester valves, and a definite indication at the surface when tool opens.

The locked open by-pass has been especially helpful in squeezing the packer through tight holes caused by filter cake. This feature serves to eliminate undue spudding and drill pipe manipulation and surging pressures on the pressure recording chart. It prevents pressure buildup below the packer, which would cause a breakdown of the formation below the packer, either the one being tested or other formations, and the possible loss of circulation. Further, it prevents the forcing of mud into the formation being tested which might prevent obtaining a successful test.

In addition, a tight packer can cause a fracture or disturbance of the formation, damaging the hole, and causing damage to the packer under some hole conditions. In almost all cases, the easy, smooth descent can be traced by the clean line on the pressure chart.

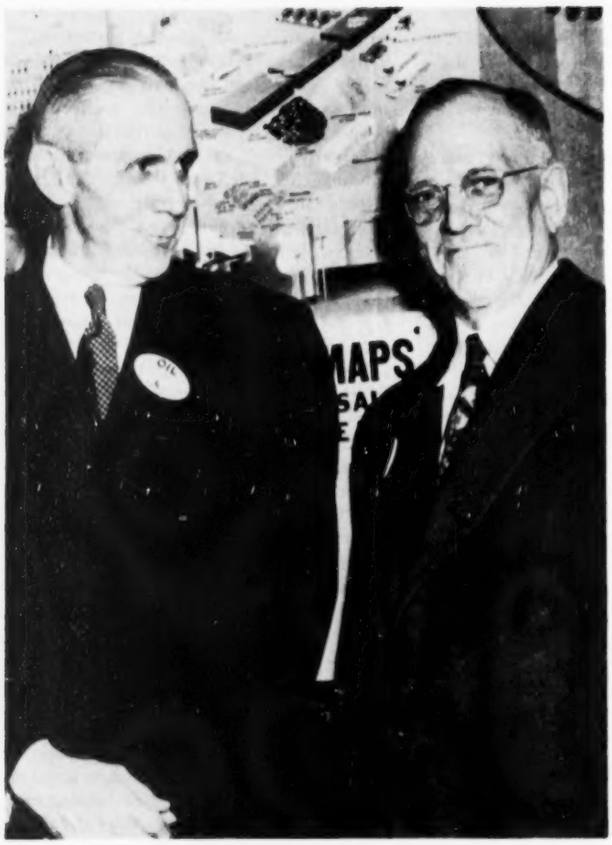
By means of a hydraulic mechanism, weight can be set on the packer and a definite time interval passes before the tester opens and the full weight of the mud is released upon the packer. The time interval also makes possible the accurate reading of the hydrostatic mud pressure on the B. T. chart. The valve mechanism is not slow opening. It is fast and positive. During the time interval, after weight has been applied and before tester opens, the valve is being positioned for opening. (Start of time delay, refer to Fig. 1; end of time delay, refer to Fig. 2; tool open, Fig. 3).

Drill pipe rotation has been eliminated by the hydraulic mechanism. When the tool reaches bottom, applying drill pipe weight and waiting for a time interval (depending upon the amount of weight set down) is all that is necessary to open the tool. The time interval prevents premature opening while going in the hole and gives sufficient time to pick up the weight in case a bridge or obstruction is hit. This feature has been very popular since it eliminates other methods of opening such as rotation of drill pipe or dropping a bar. There is no time interval when closing the tester. The tester is closed immediately by simply picking up.

A definite indication is always apparent at the surface when the tester opens, elim-

(Please turn to page 118)

*Formation Testing Supervisor, Halliburton Oil Well Cementing Co.

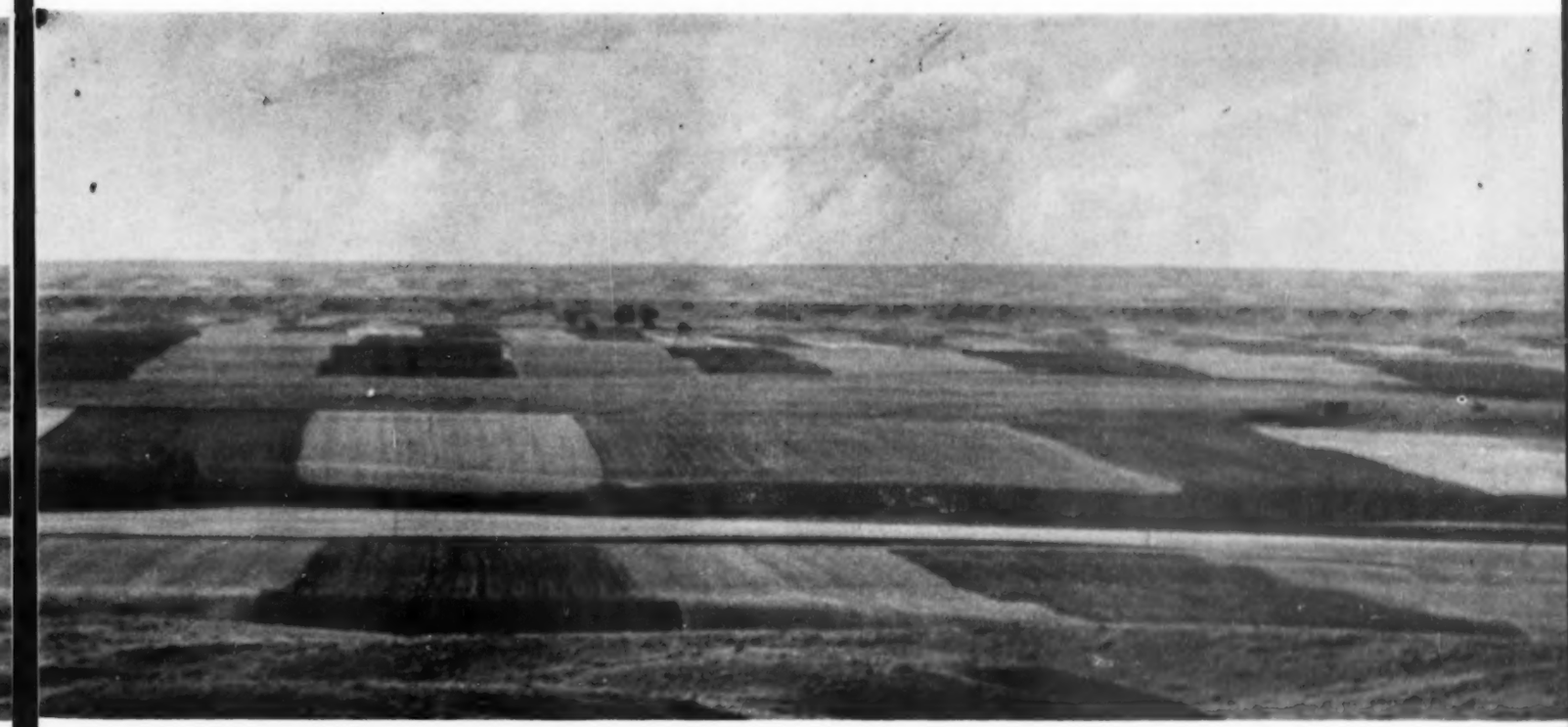


The Williston Basin

By Tom Dougherty
Staff Writer, Petroleum Information, Denver-Casper

Fourteen Williston discoveries were made in 1952 out of 61 wildcat tries in Montana and North Dakota; 6,240 crew weeks of geophysical activity was expended in reconnaissance.

Alfred Jacobsen, president of Amerada Petroleum Corp., and Gov. Norman Brunsdale of North Dakota meet in Williston on Oil Discovery Day.



holds leading place in exploratory activity

OIL IN THE WILLISTON BASIN has had widespread publicity to a degree seldom lavished on an industry or a development of natural resources. The initial discovery was recognized as "one of great potential importance" and developments of the past year have proved the aptness of the label.

Predictions of things to come in the Williston Basin made during the early part of 1952 were predicated on three wells then in production on the United States side of the basin and five producers in the Canadian portion. A considerable amount of activity was in progress as 1952 opened. Leases were eagerly sought by all types of operators, and geophysical exploration of wide areas of the basin was progressing beyond planning stages. Nevertheless, estimates of the activity then expected seemed to appear large to most observers.

Actual accomplishments made predictions at the beginning of the year appear small indeed. One informed source in North Dakota predicted in January of last year that "at least 30 wells would be drilled" within the state in 1952. That prediction fell notably short of the mark. Mid-January of 1953 found 97 producers in North Dakota alone!

Nearly 200 drilling permits were issued in North Dakota from January 1952 to January 1953, and completions during that time exceeded 125. Production in the state during 1952 was approximately 1,420,000 barrels. The rise in production during the first full year of operations is measured by the contrast between the 600 barrels per day rate at the beginning of the year and the 11,255 barrels per day being produced as the year closed.

A little more than a quarter-million feet of exploratory drilling in the state in 1952 resulted in discovery of four new pools, with a fifth apparent success still testing.

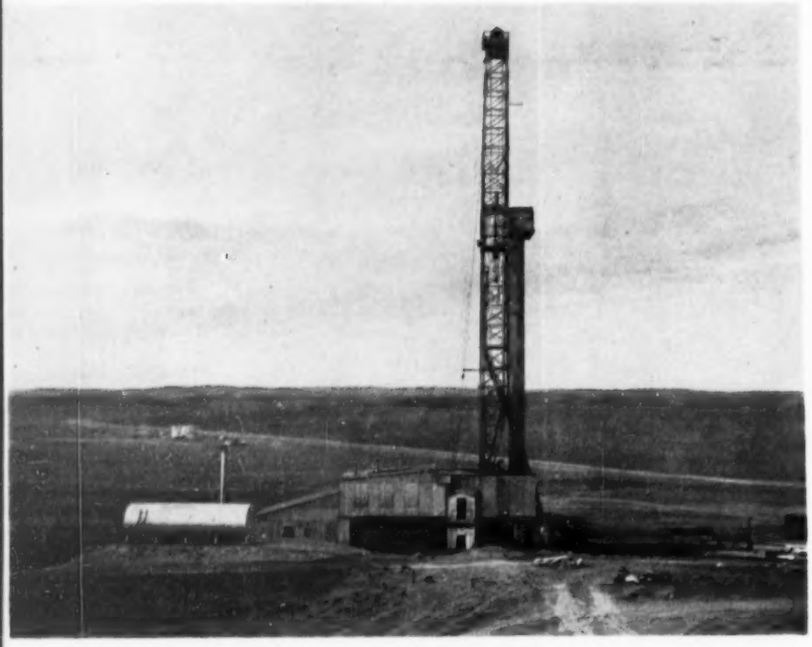
Assembly of a Williston Basin summary for Montana is more difficult than for North Dakota since all North Dakota work may be classified as within the basin, while this is not true of Montana.

Montana had ten discoveries in the Williston Basin areas during 1952. Two of these were actually made in late 1951, but final completion gauges were not obtained until early 1952. Confirmation and development work has been started at some of these discoveries, while at others nothing has been done since completion of the discovery well. Just over a half-million feet of exploratory drilling was done in Montana last year, with the majority of the work on Williston Basin projects.

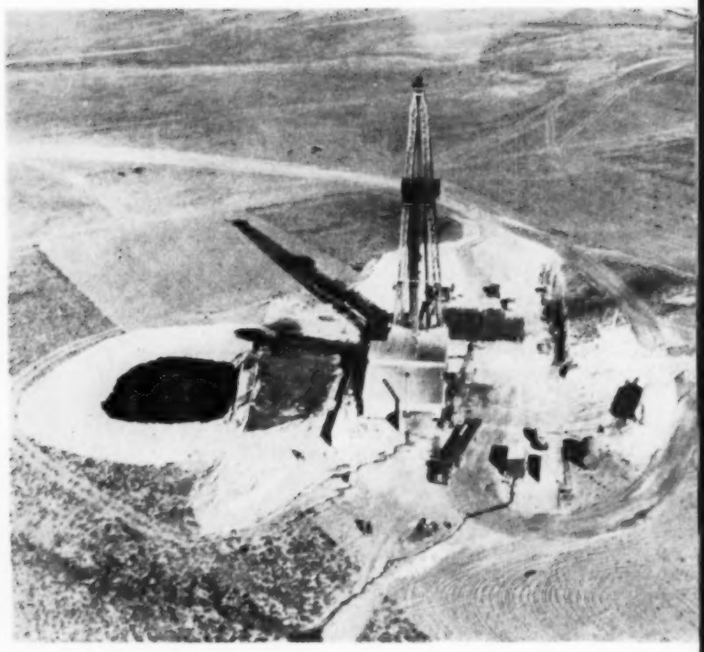
Some 50,000 feet of wildcat drilling was completed in South Dakota during 1952 without success. Interest in the state continues to rise as successes in other Williston Basin areas become more widespread.

Canadian activity was stimulated by the development and wildcat work on the United States side of the international boundary. Chief interest and activity is in an area fanning out from Virden in Manitoba in a general southwesterly direction to the northern boundary of the United States.

The expansion of the area bounded by production in the United States portion of the basin was one of the most striking, and potentially most important developments of the year. The discovery of oil in the North Wolf Point Dome area of Roosevelt County, Montana, by Continental Oil marked the first success in the basin by this operator and extended



Shell Oil Co. discovery well in the Richey field in Montana completed in November, 1952.



Mast type drilling rig used in completing Williston Basin wells in the 10,000-foot range.

production almost to the western boundary of the Montana portion of the Basin.

The anxiously sought discovery of oil on the eastern flank of the basin was made in the Turtle Mountain area of Bottineau County, North Dakota. The discovery at Little Beaver on the southern end of the Baker-Glendive anticline in Montana was the most southerly discovery. As 1952 opened the big question was whether oil would be found in areas distinct from the known surface structures of the Nesson Anticline, the Poplar Uplift and the Baker-Glendive anticline. The discovery at Wolf Point, that in the Turtle Mountain area, and the discovery southwest of the Richey field in Montana answered that important question.

This year keen interest hinges on developments in the more centrally located areas of the basin in eastern Montana, in southwestern North Dakota and in the area north of the Tioga field in northwestern North Dakota. Failures in Montana's Daniels and Sheridan Counties and in eastern Roosevelt County all had shows, but formations were too hard and tight to produce. While no successes have been drilled in this section to date, the vast area in prospect and the relatively tiny amount of drilling done has minimized the adverse effects of unsuccessful preliminary exploration. The deepest test scheduled for any area off the Nesson anticline is now under way in Richland County, Montana, a few miles northwest of the city of Sidney. This joint wildcat by Phillips Petroleum Co. and Sun Oil Co. is near the heart of the basin, and has logged shows through a thick section of Mississippian limestone, but with very little porosity apparent in stained cores recovered. It is to test to Ordovician at about 13,000 feet. New locations are in the immediate offing for the northeastern Montana area included in Sheridan and Daniel Counties.

No work has been done to date at any appreciable distance north of the producing area of the Nesson anticline in North Dakota, but location has been staked for a Divide County test.

The wildcats mentioned, and others which may be expected in an area involving some thousands of square miles in the central prospects of the basin, may be among the most vital operations of this year.

The east side of the Williston, with oil now discovered in the northern Bottineau County North Dakota district, would appear to be the second producing area in that state.

At the present time a full commercial evaluation of the discoveries in this area has not been made. The caliber of production so far found is sufficient to justify further work, but it may not as yet be regarded as a major discovery area.

However, the encouragement to further work along the eastern flank of the basin where many thousands of acres are under lease both to major companies and to independent operators is one of the important developments of 1952. There was an immediate flurry of activity through this part of the basin very shortly after the discovery of oil at Beaver Lodge by Amerada Petroleum. First efforts on the east side of the basin logged no shows, and the area, while not by any means active enough to have had conclusive evaluation, had offered no strong inducement to intensified exploration. The work done in the Westhope-Turtle Mountain area in late 1952 resulted in the most active wildcat area in North Dakota, if not in the entire basin, and two additional apparent discoveries have been made in this area since the initial strike. Consequently, it is reasonable to anticipate that extensive drilling will be done through eastern Williston basin prospects during 1953 as the interest of independent operators in particular is aroused by the demonstrated presence of oil in these areas.

Production at relatively shallow depths will insure the economic feasibility of farmouts of acreage by major operators to a great number of independents who would otherwise not be active in the basin. Such a situation will be a distinct aid to the rapid evaluation and development of the basin's prospects, much as has been the case with the Denver-Julesburg basin in Colorado and western Nebraska.

At the present time, despite the probable importance of several of the numerous discoveries within the Williston Basin, only two areas of proved major importance have been established. These, of course, are the Beaver Lodge-Tioga area in North Dakota and the East Poplar area of Roosevelt County, Montana. Other areas have not undergone sufficient development to establish their importance in comparison to these two.

A short review of the established fields of the basin, and the status and stature of discoveries made without subsequent development is of interest. Four pools were opened in northwestern North Da-

kota in 1952. With the addition of Beaver Lodge, a total of five distinct areas are now in production along the Nesson anticline. Beaver Lodge and Tioga are of course the major fields, and provide the very great majority of the more than 11,000 barrels per day being produced at the end of the year.

The discoveries officially credited to 1952 operations include: the Tioga field, where the discovery well, Amerada's Bakken 1, SW NW 12-157N-95W was officially completed in April, with a gauge of 25 barrels per hour through a quarter-inch choke from Madison. This well tested oil from both Madison (Mississippian) and Devonian formations in 1951 but was not officially completed until last year. At the end of the year 20 oil wells and four dry holes had been completed in the field.

The Croff area discovery was Amerada's 1 Risser, C SW SE 12-149N-96W, which produced from Madison at the rate of 70 barrels of oil and 14 of water in six hours through a quarter-inch choke. Producing interval in this well was lower than those of the Beaver Lodge and Croff areas, with production from 9,515-70 feet. Only other completion in the area during the year was a dry hole.

In September, 1952, Amerada opened the Charlson area with 1 North Dakota "D", C NE NW 16-153N-95W, also a Madison discovery, which flowed at the rate of 127 barrels of oil and 13 of water daily through a half-inch choke. Another well in this area was drilling as 1953 opened.

The South Beaver Lodge, of Hofflund area, was discovered in October 1952 with completion of the 1 North Dakota "E," C NW NW 16-154N-95W for an initial potential on pump of 50 barrels of oil and 33 of water daily. No additional drilling has been done in this area.

The Beaver Lodge field had some 75 producers at the end of 1952. It was a 1951 discovery, but as has been previously pointed out, there were three producers in the field as 1952 began.

Two wildcats in the Turtle Mountain area of Bottineau County were apparent discoveries at the end of January. The Zach Brooks-Crawford Smith 1 Berentson, C SW SE 21-163N-80W was pumping at the rate of 14-16 barrels of oil daily from a Mississippian interval at 3,353-65 feet. Ray Holbert Drilling Co.'s 1 Ekrehagen Estate, C NE SE 9-163N-78W, recovered 32 barrels of oil in eight hours on pump test of the interval 3,066-85 feet, and further testing awaited pump repair at the end of the month. There were six wells in this area active at the end of January, with three abandonments recorded despite some shows.

Production through this area is in the zone of the unconformity between the basal Mesozoic and the truncated Mississippian formations which rise steadily to the east from the deeper portions of the basin at the Montana-North Dakota line to the area of truncation in the eastern part of the state.

This area was suggested as a region worthy of intense exploration during the early days of production in the basin, and has been heavily covered in leasing during the past several years. Prior to the Turtle Mountain discovery the prospect, as noted above, had offered little in the way of encouragement beyond the fact that it showed conditions favorable to the accumulation of oil.

On the Montana side of the basin the discoveries during the year along the Baker-Glendive anticline in Dawson County, in the area previously lumped together as Cedar Creek, served to sub-divide that area into three distinct fields. These are Deer Creek, Sand Creek and Glendive. The Deer Creek discovery was The Texas Co.'s 1 NPG (NCT 4) C SW SW 23-17N-53E, which produced 191 barrels of oil per day flowing from Madison. One additional well was completed during the year in this area. A third attempt was dry, and additional drilling was under way at the beginning of 1953.

The Glendive field was the first to produce in this part of the Baker-Glendive anticline. Discovery was The Texas Co.'s 1 NPRR, C NE NE 35-15N-54E, which was officially gauged early in 1952 at the rate of 254 barrels of oil daily. Production was from Devonian from 9,052 to total depth of 9,079 feet. Two oil wells and three failures were completed in this area during 1952. One of the successes was Shell's northwest offset, 34-26-G, which was reported by the operator as capable of production of 6,700 barrels daily.

Sand Creek production was found in The Texas Co.'s 1 NPG (NCT 6) C SW NW 11-15N-54E, and the initial flow was 28 barrels of oil and 250 barrels of water from Devonian. No additional comple-

WILLISTON BASIN DISCOVERIES—1952

LOCATION	ELEV.	T. D.	FORMATION (TD)	PROD. INTERVAL & IP
NORTH DAKOTA				
Amerada Pet. #1 No. Dakota "D" Charlson Area, McKenzie Co. C NE NW 16-153N-95W	2474 gr	9335	Madison 8719	8998-9042 F 127 BO 13BW PD thru ½" ck 476 MCFG
Amerada Pet. #1 No. Dakota "E" Hofflund Area, Williams Co. C NW NW 16-154N-95W		8928	Madison 8482	8674-8720 P 50 BO 33BW PD
Amerada Pet. #1 BenHomer-Risser, Croff Area, McKenzie Co., C SW SE 12-149N-96W		13773		9515-70 F 70 BO 14 BW PD thru ½" ck 104 MCFG
Amerada Pet. #1 Harry Bakken Tioga, Williams Co. C SW NW 12-157N-95W		13709		
MONTANA				
Shell Oil #21-33-"B" NP SW Richey, McCone Co. C NE NW 33-22N-48E	2456 DF	9260	Silurian 9184	Perf 9090-9145, op hole 9185-9260 F 177 BOPD 2% cut thru 7/64" ck
Continental Oil #1 East No. Wolf Pt., Roosevelt Co. C NE SE 14-30N-46E	2727 gr	6448	Mis. Can. 6110	6400-25-P185 BO 65 BW PD
Ajax Oil #1 McGowan West Poplar, Roosevelt Co. C SE SW 10-29N-50E	2385 gr	6274	Madison 6200	6176-84 75 BO 25 BWPD
The Texas Co. #1 NPG-NCT #6 Sand Creek, Dawson Co. C SW NW 11-15N-54E	2496 RB	10076	Camb 10066	8992-9025 F 28 BO 250 BWPD
C. H. Murphy #10 Unit, East Poplar Area, Roosevelt Co., C SW NW 30-29N-51E	2068 gr	5787	Madison 5779	5609-17, 5627-37, 5775-5780—85.2 BO 8hr ¼" 67.9 BO 8hr 12/6 47.4 BO 8hr 8/64
Shell Oil Co. #1 Little Beaver, Little Beaver, Fallon Co., C NE SW 13-4N-61E	3090 gr	8553	Red R 8300	8474-8525 P 280 BFPD 12% cut
C. H. Murphy #1 Unit E. Poplar Roosevelt Co. C SW NE 2-28N-51E	2111 gr	9163	Lower Ordov. sand 9041	5668-80—est 400 BOPD—⅛" ck
Shell Oil Co. #1 Unit Pine Unit, Wibaux Co. SW SW NE 30-12N-57E		9746		8940-70 P 615 bbls gross, 467 BO
The Texas Co. #1 NPG-NCT #4 Deer Creek, Dawson Co. C SW SW 23-17N-53E	2552 RB	10128	Red R 9907	9810-9953—F 191 BOPD
The Texas Co. #1 NPRR "B" Glendive, Dawson Co. C NE NE 35-15N-54E		9079		9052-79-254 BOPD

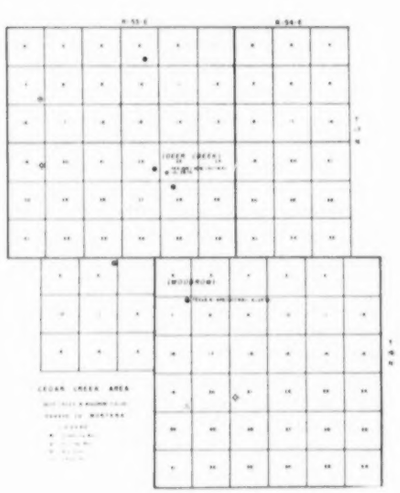
tions were effected during 1952. It is interesting to note that the discovery wells in these three fields were drilled to total depths of 10,128, 9,079, and 10,076 feet, respectively.

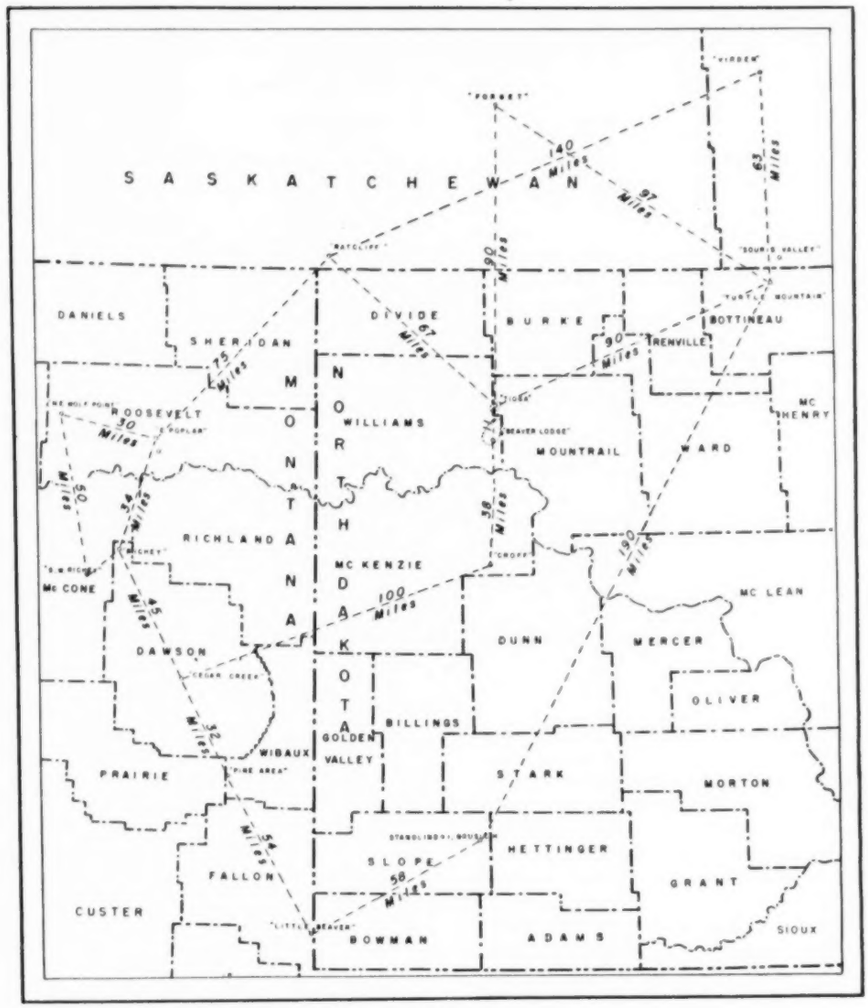
The Pine Unit discovery in Wibaux County, Montana, was announced at the end of 1951 but was not officially completed until 1952. The discovery was Shell's 1 Unit, SW SW NE 20-12N-57E, with a potential of 615 barrels fluid per day on pump. This included 467 barrels of oil, the remainder water. Production is credited to Devonian from the interval 8,940-70 feet. Total depth was 9,746 feet, and shows of possible commercial value were logged in Ordovician, with the operator definitely indicating the possibility of future completions in this formation. Two additional oil wells had been completed in this field at the end of the year, with other drilling still in progress.

Further south along the anticline Shell completed the discovery at Little Beaver, Fallon County, for a pumping potential of 280 barrels of fluid, 12 per cent water, production from Ordovician. The discovery was 1 Little Beaver, C NE SW 13-4N-61E. Additional drilling was in progress at the close of 1952.

About 15 miles southwest of the Richey discovery which opened the Montana portion of the basin, Shell found production in the No. 21-33-B-NP, C NE NW 33-22N-48E. This well produced 177 barrels of oil daily, flowing through 7/64 inch choke from Devonian-Silurian zones. Total depth was 9,260 feet. Wildcatting through this area and a confirmation well were under way at the end of 1952. The completion also induced Shell to re-work its temporarily abandoned wildcat in the Duck Creek area, about two miles northeast of this discovery, and at the present time this well is still testing.

Almost directly north of the Southwest Richey discovery Continental Oil and St. Joseph Lead Co. completed 1 Fast, C NE SE 14-30N-46E, for a pump gauge of 185 barrels of oil and 65 of water per day. Production is from Mission Canyon (Madison) and total depth is 6,448 feet. This well indicated better production than the final gauge during early tests, but difficulty was encountered in shutting off water.





General sketch of the Williston Basin area of Montana, North Dakota and Canada, showing relative position of discoveries and important shows since first production within the basin. Airline mileage separating discoveries is shown on the dotted lines.

According to reports from the area this discovery was not located as a result of geophysical work, and it is north of the Wolf Point Dome, only nearby surface structure. Shooting has been done through the area since discovery, and according to yet unofficial reports, no subsurface structure was indicated. No additional work has been done.

Three Roosevelt County discoveries were listed as 1952 completions. The East Poplar field discovery had been tested during 1951, but official gauge was released last year. Discovery well was C. H. Murphy, Jr.'s 1 Unit, C SW NE 2-28N-51E, which flowed at the rate of 400 barrels of oil daily through 1/8 inch choke with production from Charles. Eleven oil wells and one dry hole were completed in this area during the year.

Northwest of the East Poplar field, but still within the unit area, Murphy completed 10 Unit, C SW NW 30-29N-51E for a flow of 85 barrels of oil in eight hours through a quarter-inch choke with production from Madison in two distinct intervals. No further drilling has been done here.

The third Roosevelt County discovery was Ajax Oil Co.'s 1 McGowan, C SE SW 10-29N-50E, which produced 75 barrels of oil and 25 of water per day from Charles. One dry hole was drilled in this area during the year.

Production in the East Poplar area, like that in other proven Williston Basin prospects, is from Mississippian Charles and Madison formations. Possibility of production from the sands of the Heath, upper member of the Big Snowy group of the Upper Mississippian, was disclosed early in January with test of shows in this formation at Murphy's 15 Unit, C

(Please turn to page 89)

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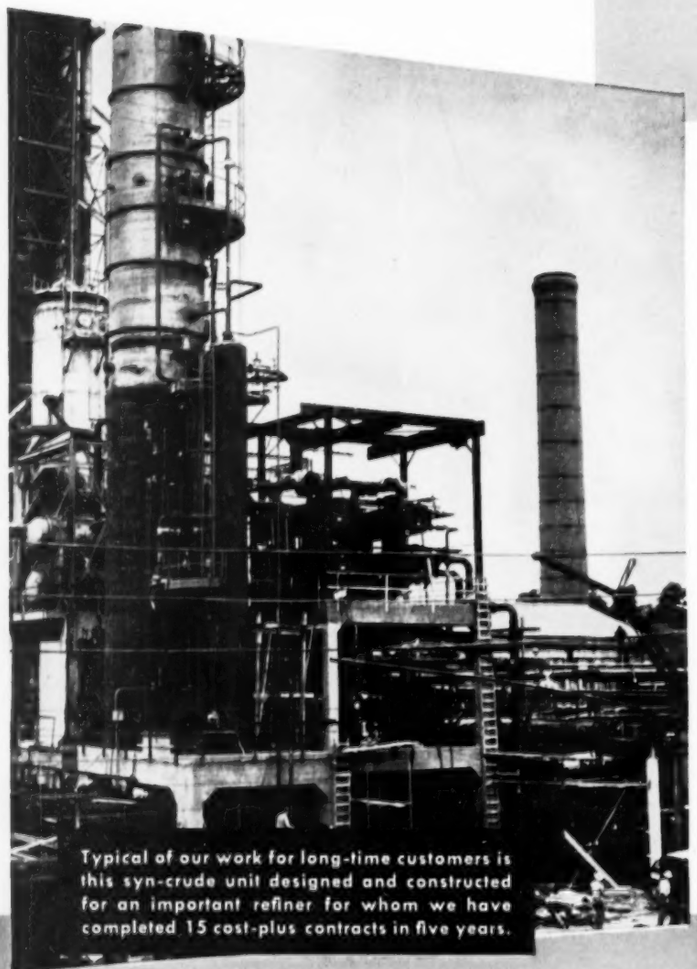

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- *Atomic Energy Commission Oak Ridge, Tennessee
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- *Canadian Oil Refineries, Ltd. Sarnia, Ontario, Canada
- *Continental Oil Company Ponca City, Oklahoma
- *Crown Central Petroleum Corp. Houston, Texas
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- *Gulf Oil Corporation Pittsburgh, Pennsylvania
- *Houdry Process Corporation Philadelphia, Pa.
- *International Minerals & Chemical Corporation Chicago, Illinois
- *Leonard Refineries, Inc. Alma, Michigan
- Ohio Oil Company Robinson, Illinois
- Pennsylvania Salt Mfg. Company Philadelphia, Pa.
- *Petco Corporation Blue Island, Illinois
- Petrol Terminal Corporation Texas City, Texas
- Polymer Corporation, Ltd. Sarnia, Ontario, Canada
- *Pure Oil Company Chicago, Illinois
- Pusey & Jones Corporation Wilmington, Delaware
- *Rohm and Haas Company Bristol, Pa.
- Shamrock Oil & Gas Corporation Sunray, Texas
- *Sharples Chemicals Inc. Wyandotte, Michigan
- *Shaw-Kendall Company Toledo, Ohio
- *Shell Berre Oil Company Paris, France
- *Sinclair Refining Company Corpus Christi, Texas
- *Socony-Vacuum Oil Company Paulsboro, N. J.
- *Standard Oil Company of Ohio Cleveland, Ohio
- Standard Oil Company of Texas El Paso, Texas
- *Sun Oil Company Philadelphia, Pa.
- Sun Oil Company, Ltd. Sarnia, Ontario, Canada
- *Susquehanna Pipe Line Company Toledo, Ohio
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The Williston Basin

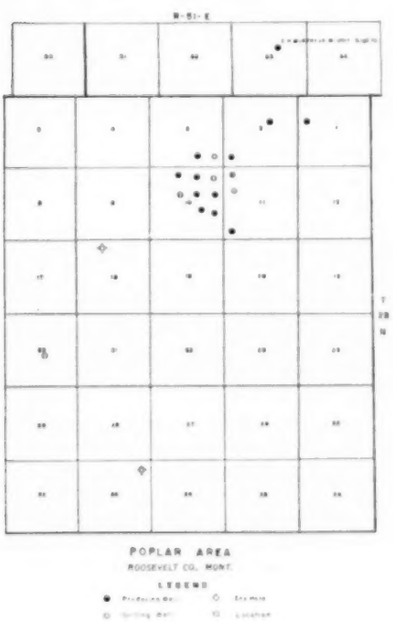
(Continued from page 86)

NW NW 11-28N-51E. Drillstem test of the interval 4,891-4,904 feet recovered 390 feet of clean, black, 39.6 gravity oil, 180 feet of oil and gas cut mud and 445 feet of slightly salty water with a show of oil and gas.

While this recovery is not particularly indicative of commercial possibilities, the show is of interest. There is at present no production from sandstones within the United States portion of the basin, and the Montana has no production from this formation. Attempted completion of this well in Heath is not now planned, but future developments may indicate the advisability of a program to this formation. The operator has not released all details on the shows encountered in Heath during drilling in this field and will withhold data pending full evaluation.

Discoveries and indicated discoveries in the Canadian portion of the basin are tabulated elsewhere. Worthy of particular mention is the test in the Forget area of Saskatchewan by Tidewater Associated Oil, about 90 miles due north of the Tioga field. This well flowed at an estimated rate of 150 barrels per hour from Mississippian formations between 3,886-95 feet. The discovery, if it lives up to early promise, is of the type that is sought all through the general east-flank area of the Williston. Further strikes of this caliber would produce a feverish exploratory campaign in these relatively shallow prospects and the possibility of such discoveries must be borne in mind as an eventuality which would have a strong influence on activity within the entire basin.

It has long since been demonstrated that not every wildcat to penetrate a likely looking spot in the Williston Basin will find oil. Wells such as Deep Rock and Stanolind's 1 Brusich, east of the Little Beaver area of Montana in Slope County, North Dakota, Deep Rock's 1 Picard in extreme eastern Roosevelt County, Montana, and others farther north in Sheridan and Daniels Counties, Montana, have revealed the presence of oil in these areas, but no commercial production has been tapped. Concentration of geophysical work in these districts plus additional wildcatting already in progress will help during this year to determine what to expect from centrally located basin prospects.



The impact of the Williston Basin on the general Rocky Mountain exploration and development picture has been huge. During 1952 a total of approximately 6,240 crew weeks of geophysical work was done in Williston Basin areas. This total was greater than the entire total for the 11-state region in 1951. It is indicative of the size of the exploratory drilling program which may be expected during coming months. At the same time, a widespread geophysical program has brought problems of its own. Interpretation of data obtained by shooting in both the Dakotas and Montana has given geophysicists a "rough" time. As additional data is accumulated by drilling, correlation of geophysical results will become easier and more meaningful, and will result in more efficient application to basin prospects.

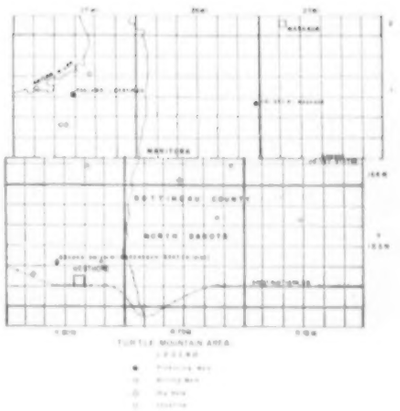
While a major portion of available lands in North Dakota was leased prior to 1952, it is estimated that the total expenditure for land and for geophysical work in the state during the year was $18 million and $15 million respectively. Land cost includes both acquisition cost of new acreage and rentals paid on previously leased lands.

In Montana these costs were estimated at $28 million for land and $16 million for geophysical work, reflecting the heavy lease play which accounted for most of the available acreage of all kinds in the state during the year.

Drilling expenditures in North Dakota during 1952 were estimated at slightly more than $32 million. In Montana these costs were fixed at $48½ million.

Generally the exploration phase of work in the basin is gathering momentum. The problems involved in both geophysical exploration and exploration by the drill have been speedily resolved and solutions, at least partial solutions, have been formulated for most of them.

The rather severe climate requires heavy winterizing in most areas of the basin, thus adding to the cost of exploration and development. Special muds and mud engineering techniques to cope with formation and temperature problems have been developed. The problem of isolation from supplies and services has been rapidly overcome by location of branch offices of all vital services and suppliers in several cities of the basin.



In consequence of a year's work, then, costs and the inconveniences of isolated operations in a new producing province have been reduced for major areas under development and exploration.

The reduction in time expended on location and consequent reduction in costs is illustrated by drilling records in the Beaver Lodge field. The discovery well logged 298 days of rig time. By mid-1952 wells were being completed in this field in 39 to 40 days.

Frozen earth, which retarded digging of pits and ditches, was sidestepped by the practice of making several locations during warm months in fields such as Beaver Lodge and Tioga, thus avoiding the necessity of digging pits during winter operations.

Cold weather work is safeguarded by provision of bunkhouses and several days' supply of food at the rig. If isolated by heavy snow or by blizzard conditions, one tour can continue to make a hole and avoid a shutdown by turning out the complete complement of hands only to make a trip.

Shutdown for weather has become as uncommon a drilling report in the Williston Basin as in any other Rocky Mountain area. Concentration on problems of the early exploration phase of the basin has not precluded attention to the pure development and production phases which are to come.

The problem of regulation is being met by the action of legislatures currently in session in both North Dakota and Montana. North Dakota had a conservation act based on Interstate Oil Compact Commission regulations before the state had any production. The legislature now in session is attacking questions of taxation, bonding of lease brokers and new regulations with respect to allowables and lease administration. Proposal for a four and one-fourth percent gross production or severance tax is being considered, with the industry generally in favor of a slightly lower levy.

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The Williston Basin

(Continued from page 89)

Allowables at North Dakota producers permit the production of 200 barrels per day. Basic consideration governing this figure is the gas-oil ratio, which has worked out to the 200 b/d figure almost without exception.

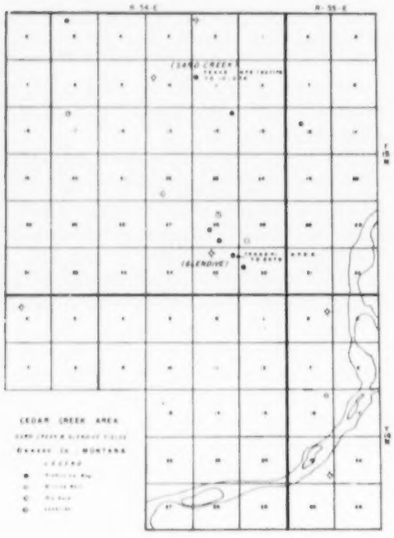
Spacing is on a 40-acre pattern provided by present regulations. An attempt to have this changed to an 80-acre pattern was made early in 1951 by Amerada, with a view to more rapid proving of the northwestern producing area. The arguments for 80-acre spacing were rejected by the state industrial commission which now administers conservation regulations. A proposal to establish a separate oil conservation commission is also pending at the legislative session.

In Montana changes are being sought in land and leasing regulations, particularly in the state land regulations which does not permit production to hold a lease longer than 20 years, at which time it must be re-negotiated.

Allowables in Montana are determined without reference to regulation. None is necessary. The problem of marketing effectively solves any rate of production argument.

The matter of marketing has had some earnest consideration. Standard Oil (Indiana) recently exercised options for purchase of a refinery site at Mandan, just north of Bismarck, and will start construction of a 30,000-barrel plant as early in 1953 as weather will permit. The refinery is expected to be in operation about October 1954. Present production is about one-third of that necessary to operate this plant to capacity.

A pipe line from the Beaver Lodge-Tioga area to the Mandan refinery is also projected, with some consideration being given to construction of a line eastward from the refinery to tie in with the Standard Oil products line from Whiting, Indiana at Fargo. This project has not advanced beyond speculative consideration, according to Standard spokesmen.



The importance of the marketing situation can be aptly summed up by the fact that crude of a grade normally posted at about $2.50 per barrel at the well is now bringing $2.00 in the Beaver Lodge area.

Market outlets for Montana fields are also sorely needed. Production in the East Poplar and Richey fields is trucked to railhead at Circle, Montana, and then shipped to the Pacific Northwest. Some of this crude is being shipped from coastal rail terminals to Shell's refinery at Richmond, California. Movement to such distant markets imposes heavy price penalties for producers in an area where drilling and production costs are high.

Some relief is in sight for Montana producers. The proposal of a 25,000 barrel per day products pipe line from Billings to the Pacific Northwest which has been advanced by Continental Oil would require additional refining capacity if regional demands, plus the requirements of such a line, are to be met. Speculation that refining capacity in the Billings area, which now amounts to about 40,000 barrels per day, might be expanded has been heard. Some expansion would be necessary to fill the proposed line.

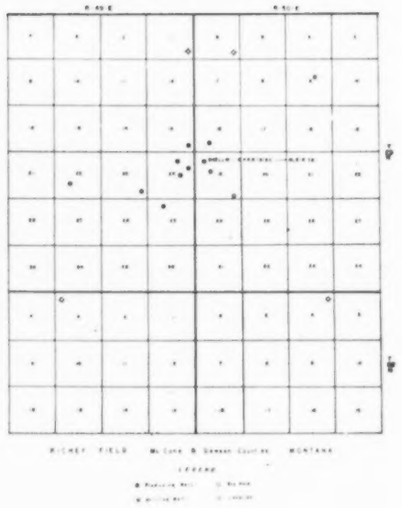
Logical source of production for such expanded refinery capacity would be the East Poplar, Richey, and North Wolf Point areas, as well as other fields in development along the Baker-Glendive anticline.

Production now obtained from the Elk Basin field in north-western Wyoming, which supplies the bulk of Billings refinery requirements, could be diverted to the newly operative Platte Pipe Line when production in the areas named above becomes sufficient for the needs of refining capacity then in operation.

The possibility of a crude line from the Williston Basin with terminals in both midwest and Pacific Northwest areas has been considered. So far as such a line is concerned, the economics of the situation dictates that no line shall be built until reserves have reached a volume greater than is likely within the next year or two.

Disposition and utilization of field gas is being attacked by Amerada with the construction of a natural gasoline plant and a sulfur recovery plant in the Tioga area. Current plans call for a beginning of construction in 1953. Cost estimate has not been released pending final decision as to details of capacity and type of plant, but the project is estimated as within the cost range of $10 to $20 million.

Logical market for the sweet gas output of the Amerada plant is the Montana-Dakota Utilities Co. which serves a major portion of the Williston Basin area.



The Williston Basin has made long strides for such a young province. The area is in the midst of an intensive exploratory phase with every indication that it will continue to increase during the immediate future.

The effect of the development and exploration of the basin on the region at large has been salutary. Activity within the basin has attracted additional expenditures throughout the area. New operators have been attracted to various parts of the region through the publicity given the Williston Basin.

Expansion of the cities and villages within the basin has been phenomenal. Residential and commercial building has been supplemented by trailer camps, temporary commercial construction, and by conversion of older structures such as grain warehouses to oil industry use.

Expansion has been orderly, and on a long range basis. Residents of the area were quick to take hold of the opportunities presented. Several cities of 5,000 to 8,000 population called in professional city planners and have provided for expansion to cities of 20,000 or more on an approved and carefully designed basis.

Residents of the area are not oil crazy, but they are certainly happy about the revolution which has overtaken their economy.

Last year the Rocky Mountain region, largely influenced by the Williston Basin, had more than 30 percent of the nation's total geophysical activity. Residents of the region, the Williston Basin in particular, would be happy to see that percentage of the nation's drilling rigs active there.

There are some exceptions such as the stern-minded widow who, when asked to comment on a wildcat location on her son's place which adjourned hers, said "I don't want to see any of this oil coming up on my land, or my son's land either. There ain't no good in money you don't have to earn." Her fears were groundless. The well was a dry hole.

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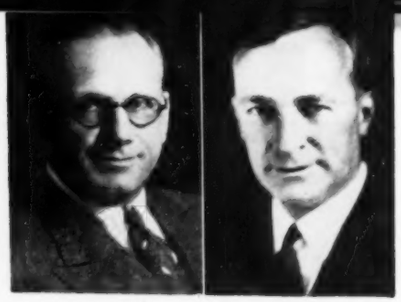
Texaco top management changed by Rodgers–Klein retirements



W. S. S. Rodgers *H. T. Klein*

J. L. LEACH, president of The Texas Company for the past year, was elected chairman and chief executive officer of the company on March 1. He was succeeded as president by A. C. Long, former executive vice president.

The promotions of Messrs. Leach and Long came as a result of the retirement of W. S. S. Rodgers as chairman and of Col. Harry T. Klein as president. Both had reached the company's compulsory retirement age.

All of the men involved in the shift in management are veterans in the Texaco organization. Combined service of the four aggregates more than 125 years.

Mr. Rodgers, who retired as chairman, was a miner in his youth, but entered the oil business in the Midway Sunset field in California in 1911. He joined Texaco in 1915 and has served the company continuously since then except for two years of service in the U. S. Army during World War I. He worked in the refining department in his early years with the company, serving as superintendent in the terminal division. At one time he was assistant general superintendent of Port Arthur Works and general superintendent of the terminal division.

In 1925, he was assigned to special duties in the executive offices, and in 1926 became assistant to the president. He was elected vice president in charge of domestic sales and a director in 1928; and in 1929 was made a member of the executive committee. He was elected president in 1933, and chairman in 1944.

During World War II, Mr. Rodgers served as a member of the Petroleum Industry Council for National Defense (later the Petroleum Industry War Council), and the Committee on Synthetic Rubber, of which he was chairman.

Colonel Harry T. Klein, who retired as chairman of the executive committee, also saw army service in World War I. He was the first Major Judge Advocate appointed in France. He was promoted to the rank of Lieutenant Colonel Judge Advocate, and later served as special counsel to the U. S. Liquidation Commission in France until April, 1920. He is an officer of the French Legion of Honor and was awarded the American Distinguished Service Medal.

Colonel Klein entered the service of The Texas Co. in 1921 as assistant general counsel, and was appointed general counsel in 1925. In 1933 he was elected a vice president, a director and a member of the executive committee. In 1940 he was made executive vice president and general counsel. On April 25, 1944, he was elected president and in 1952 chairman of the executive committee.

Colonel Klein is a director of The Texas Co., the Texaco Development Corp., Indian Refining Co., McColl-Frontenac Oil Co., Ltd., Seaboard Oil Co., Coltexo Corp., Carthage Hydrocol, Inc., Arabian American Oil Co., and the Trans-Arabian Pipe Line Co.

J. Sayles Leach, new chief executive of Texaco, joined the company in 1916 in the Dallas office of the sales department. He was elected a vice president in 1938, a director in 1949, executive vice president in 1950, and president on April 22, 1952.

Mr. Leach also was elected a director and vice chairman of the board of the executive committee of the Jefferson Chemical Co. in 1952. He is also a director of the National Bank of Commerce at Houston, the Seaboard Oil Co. of Delaware, and McColl-Frontenac Oil Co., Ltd.

Mr. Leach is a member of the National Petroleum Council, the Mid-Continent Oil and Gas Association, a director of the American Petroleum Institute, chairman of the A.P.I. Study Committee on Special Projects, and a member of the A.P.I. Safety Committee and the Agricultural Advisory Committee.

New Texaco President A. C. Long was graduated from the U. S. Naval Academy in 1926, and served approximately four years in the Navy. He joined The Texas Co. on January 1, 1930 as a service station supervisor for the sales department in Florida. The following year he was transferred to the company's export department, serving as general manager in Ireland until February 1934, when he was transferred to The Hague, Netherlands, as manager of the Dutch subsidiary. He returned to the United States in 1940.

During World War II, Mr. Long returned to the Navy and served in South America and Washington before going to London as a petroleum attache to assist in coordinating allied petroleum supplies.

After his return to the company, Mr. Long was appointed assistant manager of the central territory at Chicago, but later transferred to New York as manager of the foreign sales division. In 1946 he was appointed assistant to the vice president in charge of foreign operations and on January 1, 1947 he became vice president of the California Texas Oil Co., Ltd., in charge of marketing west of Suez.

In November 1948 he returned to Texaco as assistant to the chairman. He was elected vice president in charge of foreign operations, eastern hemisphere, in June, 1949; was elected a director on August 4, 1950; and was elected executive vice president on January 26, 1951. He is also a director of the Texaco Development Corp., the Arabian American Oil Co., and the Trans-Arabian Pipe Line Co.

J. W. Foley, assistant to the chairman, has been elected a vice president. He will continue to serve as assistant to the chairman. Mr. Foley has had wide experience in both domestic and foreign oil operations. He started with Texaco in 1932 as a rotary rig helper, and a year later became a petroleum engineer. From 1937 to 1940 he was petroleum engineer for Bahrein Petroleum Co., Ltd., on Bahrein Island in the Persian Gulf. Returning to this country, he was located in Louisiana, and later became superintendent of gas-gasoline operations.

In 1947 Mr. Foley went to Houston as assistant to the manager of the producing department. In 1948 he was named assistant division manager of the Oklahoma division at Tulsa. In 1949 he was made assistant to the vice president, producing department, New York. In 1950 he became assistant to the chairman.

J. S. Leach

A. C. Long

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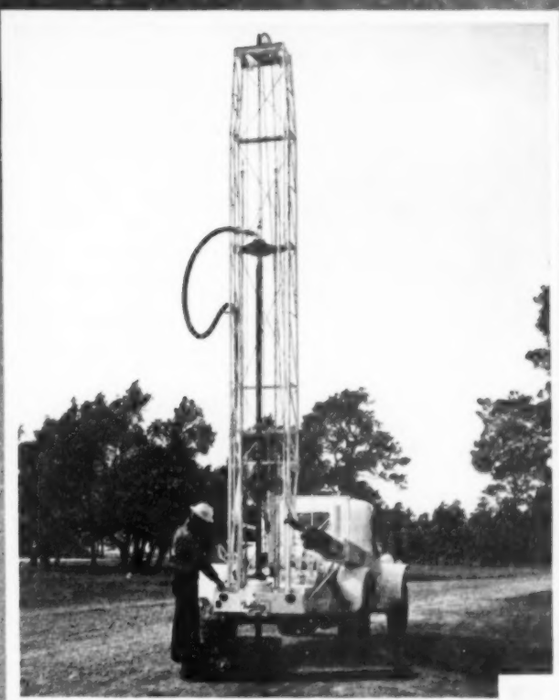

SPECIFICATIONS

RATED CAPACITY: Shot holes to 350 feet, using 2⅜" special light weight drill pipe.

MAST: Seamless alloy steel tubing. Rated capacity 5,000 pounds. Hydraulically raised and lowered. Clear height above rotary table, 18 feet.

KELLY: FAILING patented, round, 3 fluted, 2⅜" diameter.

ROTARY TABLE: Opening, 4 5/16". Spiral bevel gears. Oil bath lubricated. Designed for use with drill pipe break-out slips.

DRAW WORKS: Two drums, individual friction clutch operated. Self-energizing brakes. Rated single line pull, 2,500 pounds.

CHAIN FEED: The same hydraulic feed system as used on the CFD-1 is used, except it is actuated by a single hydraulic motor.

TRANSMISSION: Three speeds forward with reverse. Controlled from driller's station through 9" single-plate clutch. Mounted on sub drive case, driven by double roller chain and heat treated sprockets.

FRAME: Light weight, fabricated steel with drill pipe rack on right hand side.

MUD PUMP: FAILING L-100, 4½ x 5, duplex type pump.

MISCELLANEOUS: Conveniently grouped controls. Tapered roller bearing, 1¼ inch water swivel. Fabricated steel yoke with replaceable guide shoes. Equipped with reflectors and wired for clearance lights.

WEIGHT: Drill complete less truck and drill pipe, 3,200 pounds. Suitable for mounting on Dodge Power Wagon with special FAILING full-torque Power Take-Off.

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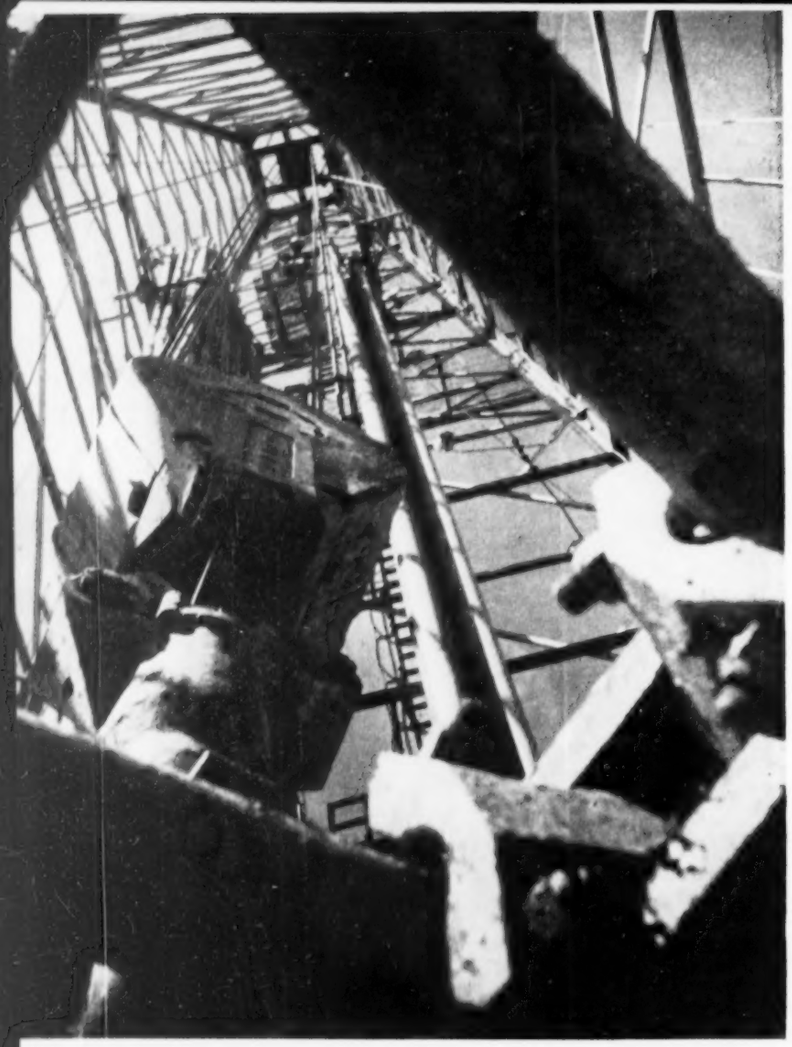


Drilling rig operating in the Languedoc area in southern France.

FRENCH TO PUSH OIL EXPLORATION

By H. M. Ballande President, Societe Nationale des Petroles du Languedoc Mediterranean (SNPLM).

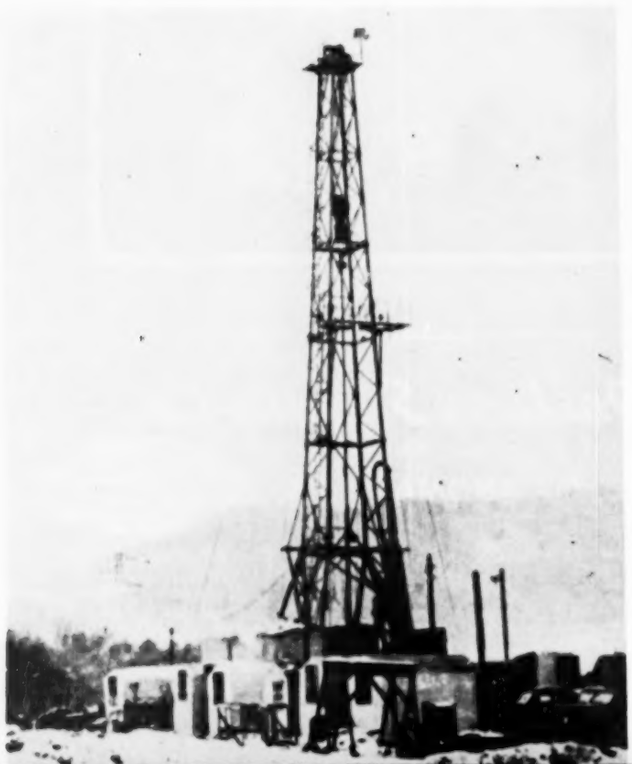
THE DEVELOPMENT of oil prospecting in the countries of the French Union in the past six years has had notable results which have previously been noted in WORLD PETROLEUM. These results may appear relatively modest when compared with the abundant reserves of the principal producing countries, but their encouraging character is not to be denied.

Table I shows that production of crude oil was tripled between 1950 and 1952. Today Metropolitan France is producing an average of 7,500 b/d to which is to be added 1,006 million cubic feet of natural gas per day. Morocco is producing nearly 2,000 b/d and Algeria is producing at nearly the same rate.

The activities of the French companies exploring for petroleum are developing along the lines of the five-year plan which coordinates the work of all such enterprises, whether they are backed by private capital or by public funds. Therefore, to obtain an idea of how the general prospecting effort is developing it will be sufficient to examine the trend of the plan that is now in process of execution.

The essential characteristic of this effort is, at the present time, distinctly expansionist. There is no sign of a letdown; on the contrary, there is evidence of a determination to stick to the program and even to enlarge it, principally by opening two vast areas that heretofore have been kept in the background: the Sahara and the Paris Basin.

Although the current five-year plan, designed for the years 1951 to 1955 inclusive, have been in progress only two years, the rapid evolution of certain factors has already led to a readjustment of the immediate objectives and the measures to be put into effect during the three remaining years. On the one hand, experience in the past campaigns has made it possible to make a clearer definition of optimum working conditions. On the other hand, discoveries and other encouraging circumstances at the foot of the Pyrenees, in Algeria, and in the Al

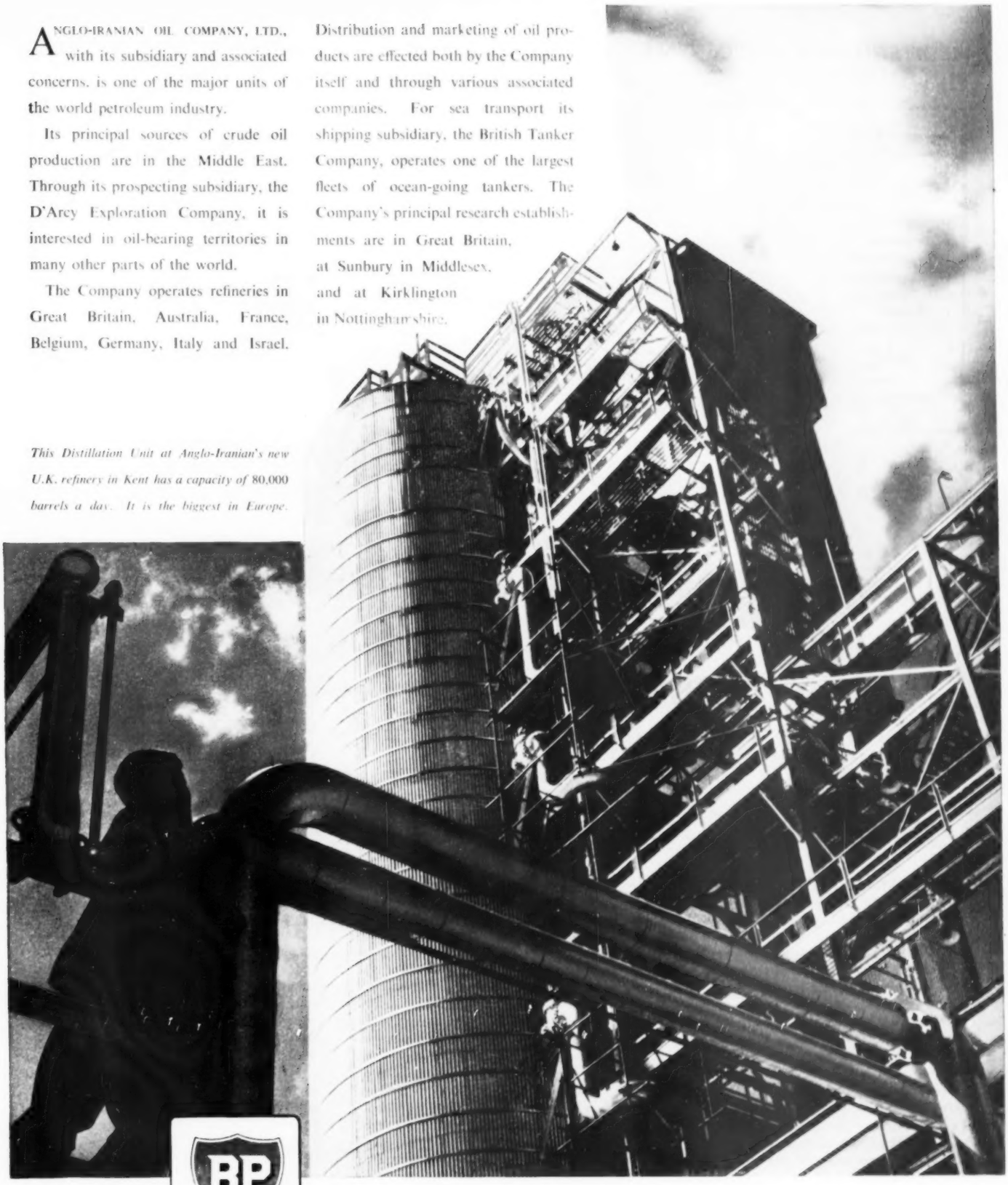


Portable mast employed in drilling in Lorraine, northeastern France.

ANGLO-IRANIAN OIL COMPANY, LTD., with its subsidiary and associated concerns, is one of the major units of the world petroleum industry.

Its principal sources of crude oil production are in the Middle East. Through its prospecting subsidiary, the D'Arcy Exploration Company, it is interested in oil-bearing territories in many other parts of the world.

The Company operates refineries in Great Britain, Australia, France, Belgium, Germany, Italy and Israel. Distribution and marketing of oil products are effected both by the Company itself and through various associated companies. For sea transport its shipping subsidiary, the British Tanker Company, operates one of the largest fleets of ocean-going tankers. The Company's principal research establishments are in Great Britain, at Sunbury in Middlesex, and at Kirklington in Nottinghamshire.



This Distillation Unit at Anglo-Iranian's new U.K. refinery in Kent has a capacity of 80,000 barrels a day. It is the biggest in Europe.

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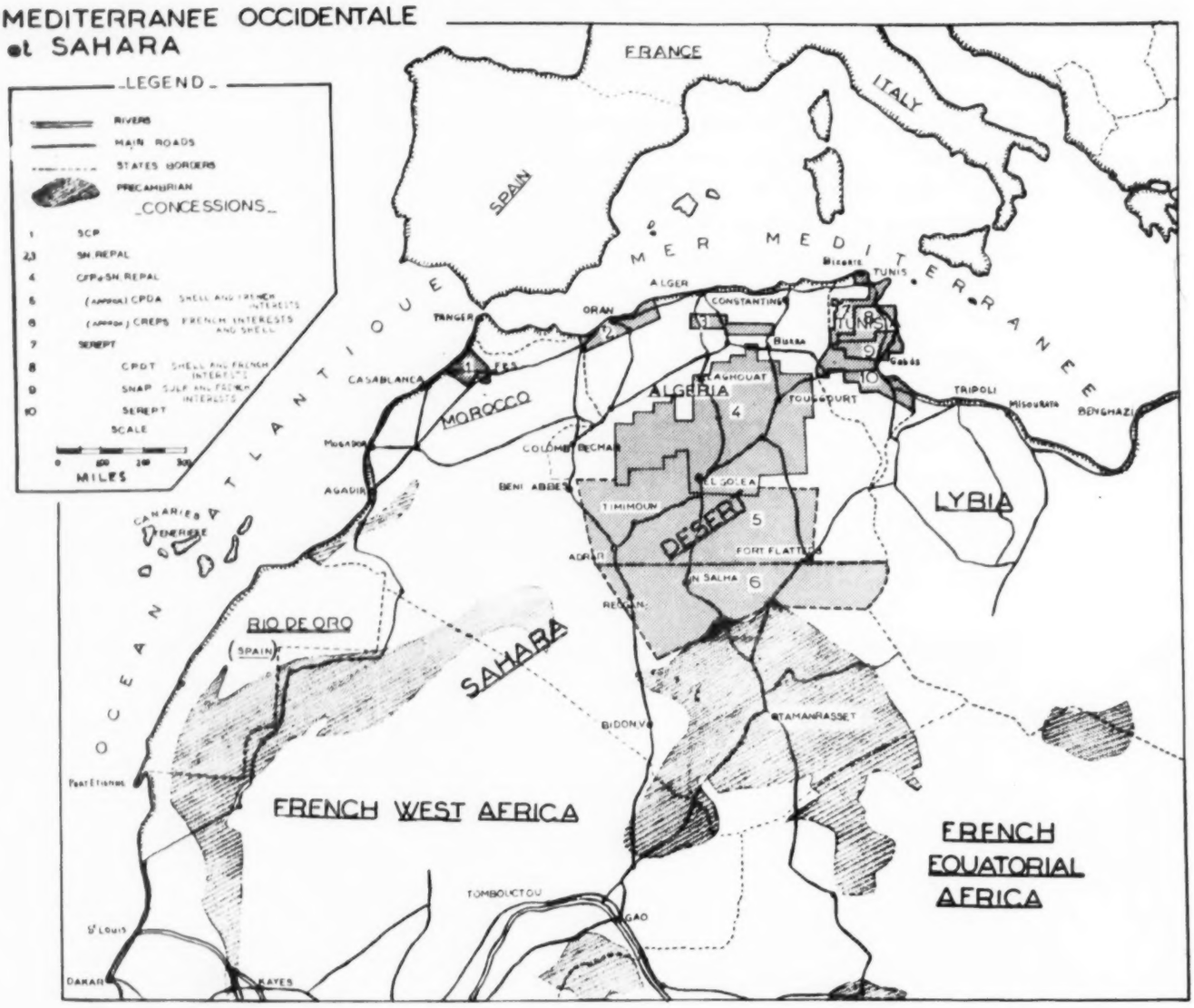

satian Plain have justified an intensification of prospecting by private capital.

The evolution of working methods is characterized by an intensification of preparatory geological work, particularly in geophysics. Since the horizons to be explored are generally hidden under discordant masses, it is necessary to provide for greater use of seismic equipment; the number of crews will be increased from 20 in 1953 to more than 30 in 1955. The importance of this development may be realized when it is considered that only three seismic crews were at work in French territory in 1948. A dozen crews are considered necessary for general geophysical reconnaisance by gravimetric and magnetic methods.

It is probable that greater use will be made of core drilling for defining structural problems. With this in view, the number of shallow-drilling units, which is now 25, will be increased except for certain sectors of the Sahara, the Paris Basin, and the deep extension of the Lacq deposit. It is considered that the new problems to be solved justify the use of this category of equipment.

As regards the organization for prospecting, arrangements are made for pre-reconnaissance studies directed and financed by the Bureau of Petroleum Research (BRP). This is a public establishment subordinate to the Ministry of Industry and Commerce, the object of which is to promote and coordinate prospecting for and production of petroleum and natural gas, with the idea of directing the attention of oil-prospecting companies toward certain heretofore unexplored sectors. The working program in general comprises geological and geophysical reconnaissance and a certain amount of core drilling. The results will be given out in widely circulated reports. After completion of the study of the Paris Basin with the cooperation of the French Institute of Petroleum, the BRP will direct its activities toward other basins in Metropolitan France and certain territories of Africa.

Another notable fact in the development of prospecting for oil in the territories under the French flag is the growing interest in these territories shown by the international petroleum groups. Since the entry of Standard Oil (New Jersey) into Southwest France, and Gulf and Shell in Tunisia, Shell has requested a new permit for prospecting in the Sahara, following a move by the Compagnie Francaise des Petroles which has already begun work on the Algero-Saharan border. This display of interest in vast, practically unexplored basins in French territory undoubtedly will have its effect on certain other capitalist groups that have been hesitating to venture into such virtually unknown regions. Certain qualified organizations already have made known their interest in the Paris Basin (66,000 square miles wherein no permit

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Winter drilling operation in southern France.

for prospecting has yet been granted), and in the Sahara, where scarcely half of the sedimentary terrain has been covered by requests for permits.

There is no reason to doubt that a loyal and confident collaboration between French interests and great companies with long experience and vast financial resources could be a decisive factor in the rapid development of petroleum production in these areas.

Tables II and III give a summary of the increase of equipment that has been put to work during the past three years and the drilling results therefrom. It is expected that the number of drilling rigs capable of reaching or passing 9,000 feet will progressively increase to about sixty by 1955. The footage drilled annually between 1952 and 1955 is expected to increase 30 to 40 per cent.

This increased activity will evidently require further financing, which is now figured at about 300 million dollars or the equivalent in exchange, the total contemplated by the current five-year plan. Of this amount the part allotted to the next three years (1953-55) will not be far from 200 million dollars.

The scope and the difficulties of prospecting in the overseas territories will call for a notable proportion of the total financial effort. It is now expected that the portion allotted to North Africa in 1953 will largely exceed the part allotted to France proper, and a fourth of this will be set aside for the Sahara.

Table IV shows the sources of financing during recent years and reveals a progressive decrease in the portion supplied by public funds, which declined from 1948 to 1952 from 50 percent to 40 percent. This tendency no doubt will continue in the future, and conversely, a larger part will be taken over by private parties.

However, it is not to be concluded that private savings will play an important role unless Parliament adopts legislation proposed by the oil men with the backing of the BRP. These proposed laws aim at adapting the legislation now in force in the United States and Canada to French fiscal regulations and in particular to the industrial structure affected by French mining law. One of these proposed laws would dispense with the tax on subscriptions to the stocks or shares of companies engaged in prospecting for petroleum. The other is an exact copy of American legislation authorizing provisions for secondary recovery in oil reservoirs. The adoption of these proposals, which at present seem to have a reasonable chance of success, are evidently of a nature to accelerate projects in the domain of oil prospecting.

It is obviously difficult to make a reasonable guess as to results to be expected from such a considerable financial effort. Certain prudent specialists think it likely that the gross production of crude oil may be doubled in the course of the next three years and that it is not beyond the limits of reason to expect it to reach around 24,000 b/d.

Looking beyond the current plan, one could make some guesses for the next five years which might be regarded as wishful thinking rather than as bases for a new five-year plan.

Thus, in 1956 the financing of petroleum prospecting may exceed $85 million, 50 percent from self-financing, 25 percent from private and mixed sources, and 25 percent from public funds.

For each of the succeeding years the rate of investment may increase 10 percent without straining the country's resources of qualified personnel and equipment.

The development of this plan will naturally depend on how much encouragement is provided by preliminary prospecting. If the results are favorable, and especially if there is a marked decrease in the cost of financing a ton of oil reserves, which as present amounts to $17, the scale of operations could correspond to an annual expenditure of about $115 million in 1960, which would be 2.7 times as much as in 1952. Under this hypothesis, the production obtained would put at the disposition of the French economy a relatively important part of its need for petroleum products, which would not be far from 500,000 b/d, and the expense of prospecting would be almost wholly covered by company financing.

This development program may be characterized as "ambitious." However, it has to be admitted that in petroleum prospecting it is not the brashest enterprises that pay off the least; this is proved by examples in Canada and the Middle East, among others. On the other hand, what might be said about the "ambition" of a country in which the production of coal shows an annual deficit of 12 million tons, which imports from foreign countries 96.5 percent of its petroleum consumption, and which at the same time controls nearly ten percent of known sedimentary areas?

TABLE I

FRENCH PRODUCTION OF CRUDE PETROLEUM

(Barrels per Day)

Year	France Proper	Algeria	Morocco	Total
1938	1,500	Less than 10	100	600
1950	2,560	68	786	3,414
1951	5,858	144	1,512	7,514
Average 3rd Quarter 1952	7,310	1,200	1,895	10,405

TABLE II

DRILLING RIGS IN ACTION

(not including geological drilling and drilling for Pechelbronn production)

	1948	1949	1950	1951	1952
Rigs For General Reconnaissance					
France Proper	4	4	2	6	3
French No. Africa	4	4	7	5	3
French Overseas	2	3	3	3	2
Total	10	11	12	14	8
Crews For Seismic Prospecting					
France Proper	2	3	5	5	8
French No. Africa	1	3	5	7	8
French Overseas		1	2	4	4
Total	3	7	12	16	20
Light Apparatus					
France Proper	6	6	8	4	6
French No. Africa	4	4	3	5	5
French Overseas	—	—	1	1	2
Total	10	10	12	10	13
Medium Rigs					
France Proper	2	2	7	9	10
French No. Africa	5	5	6	6	6
French Overseas	1	1	1	2	2
Total	8	8	14	17	18
Large Rigs					
France Proper	18	18	14	12	12
French No. Africa	5	5	5	7	8
French Overseas	1	1	—	—	1
Total	24	24	19	19	21

TABLE III

ANNUAL PROGRESS IN DRILLING

(Feet)

Year	France Proper	French No. Africa	French Overseas	Total
1948	136,000	232,000	10,000	378,000
1949	144,000	270,000	10,000	424,000
1950	250,000	353,000	55,000	658,000
1951	300,000	460,000	30,000	790,000
Total Expected 1952				900,000

TABLE IV

FINANCIAL BREAK-DOWN ACCORDING TO ORIGIN OF FUNDS

(In Percent)

	1948	1949	1950	1951	1952
Self Financed	28.7	39.9	39.8	51.6	52.0
Private and Mixed Participation	21.1	12.8	7.3	6.5	5.5
States and Territories Overseas	13.3	13.6	14.9	13.2	16.0
Budget subvention to BRP	36.9	33.7	38.0	28.7	26.5
	100.0	100.0	100.0	100.0	100.0

Exploration builds German production

By Alfred M. Stahmer

IN 1952 THE EXPLORATION activity of German oil companies achieved noteworthy results and prospects seem good for continuing the series of prolific finds in 1953. Apart from important extensions carried out in older fields such as Hohne (Hannover), Scheerhorn (Emsland) and Heide (Schleswig-Holstein), six new oil fields and two natural gas deposits were discovered in the past year, adding some millions of tons to the reserves of West Germany which, as of January 1, 1952, were estimated at about 40.7 million tons or nearly 300 million barrels. For January of this year two further new finds can be reported.

The significance of the exploration results in 1952 is that deposits were found at places and in formations where in former times no oil had been expected or where wildcatting had been unsuccessful. Particularly, the application of modern reflection seismic methods opened new aspects in the search for oil, as for instance in eastern and southern Holstein and in the Upper Rhine Valley Graben.

In the province of Schleswig-Holstein hitherto only one field was exploited on the top of the long narrow salt structure of Heide-Hemminstedt, the pay horizons being of Cretaceous and Zechstein age. In late January 1952, Deutsche Erdoel-AG's wildcat Hohenwoehrden 2a made the first discovery of oil in the Wealden (L. Cretaceous) and Dogger (Jurassic) which horizons up to now were known as oil bearing only in the Hannover and Emsland areas.

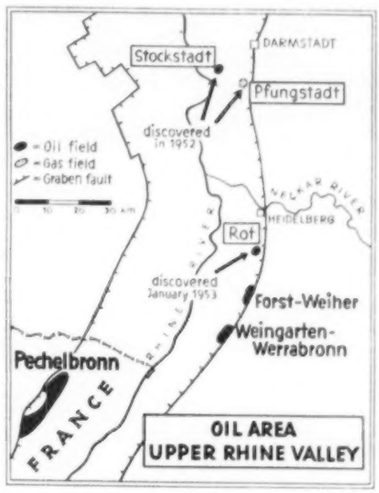
While Hohenwoehrden, situated on the deep western flank of the Heide structure, was more or less an extension of that field, the successful exploration well of Deutsche Vacuum Oel AG (Socony-Vacuum affiliate) at Boostedt near the town of Neumuenster in East Holstein was a striking find in a region where former wildcats had brought negative results only. Boostedt is situated on the eastern flank of an elongated salt upthrust which borders the deep sedimentary basin around the north of Hamburg called the "Hamburger Loch." The concession of Boostedt is a joint interest of Deutsche Vacuum-Deutsche Erdoel-AG and Preussag. Two years ago, in the Hamburger Loch, an exploration well of Gewerkschaft Elwerath discovered oil traces in the Dogger at Hohenhron, but this find was not commercial. Boostedt for the first time opened a productive Dogger horizon, the first well yielding about 35 tons of light oil daily through a 0.16 inch choke.

In November, some eight miles northeast of Boostedt, Deutsche Erdoel-AG's wildcat Ploen-Wankendorf-2, on the flank of the same salt structure, became successful with a similar yield from the Dogger. In December 1952, Boostedt produced from two wells some 7,400 tons of crude oil and Ploen 850 tons.

In the Hannover oil province, two successful wildcats were reported by Preussag, both on salt dome structures. In August 1952, some miles from the town of Hannover, the well Lehrte-12 struck oil in the Cornbrash sandstone at a depth of about 3,950 feet. After water troubles in the deeper part of the pay were overcome, the hole flowed three cubic meters of crude oil (specific gravity 0.871) daily through an 0.08 inch choke.

Vorhop 5a, a joint interest of Preussag and Gewerkschaft Elwerath, situated on the southern edge of a salt structure east of the Wesendorf field, encountered oil and become a pumper with a small yield from the Dogger.

Halfway between Hannover and the River Ems a new oil area has been developed in the course of the past few years. In 1951 the field Hemmelte-West was discovered by Deutsche Vacuum and Gewerkschaft Brigitta. In 1952 the Wintershall AG was successful in its exploration wells Rehden-5 and Aldorf-1 near the small town of Diepholz in the area between Bremen and Osnabrueck. Rehden-5 opened a natural gas deposit in the Zechstein, producing about 90,000 cubic meters a day through a 0.2 inch choke. Aldorf-1, which had been located on the flank of a pre-Cretaceous structure, at present pumps about 10 tons of crude per day from two Cornbrash sands of the Dogger epsilon.



The latest discovery in the new Weser-Ems oil province is the wildcat Molbergen-2 of Deutsche Vacuum and Gewerkschaft Brigitta, which is situated about five miles north of the oil field Hemmelte-West in South Oldenburg. In late January 1953, the well encountered oil bearing layers of the Malm (Jurassic) at a depth of 2,400 feet. A drill-stem test resulted in a good oil flow, the crude being of medium quality with a specific gravity of 0.89. This well will be sunk to greater depths.

Of great importance to future oil search in the Upper Rhine valley are the discoveries of Stockstadt, Pfungstadt and Rot which were made by Gewerkschaft Elwerath, Deutsche Erdoel-AG and a joint interest of Itag and Wintershall AG in late 1952 and in the beginning of this year. The result of Gewerkschaft Elwerath's exploration well Stockstadt-1, situated south of Wolfskehlen (where a wild gas blow-out occurred in August 1951) is particularly significant because Pechelbronn layers (Oligocene) which are the pay in the French field Pechelbronn, were for the first time found to be oil bearing as far north as here. Furthermore this is the first instance where oil has been found in the center of the Rhine Valley Graben. The initial production of Stockstadt-1 amounted to 60 cubic meters of light crude (specific gravity 0.825-0.830) through a 0.12 inch choke.

Some miles east of Stockstadt, Deutsche Erdoel-AG was successful with its wildcat Pfungstadt-2 which encountered a natural gas deposit in the hydrobia layers. In January 1953, the series of new discoveries in the Upper Rhine area was continued by the well Rot-3 (Itag-Wintershall) which struck oil in the Lettenkohle (Triassic) at a depth of 2,100-2,300 feet about 10 miles south of Heidelberg. Apparently the oil comes from fissures. Production tests are still under way.

At a total of 1,755,430 tons, West Germany's crude oil production in 1952 was 28.5 percent higher than in the preceding year, while 32.4 percent of the German refinery intake consisted of indigenous crude. The steadily increasing production is backed by the extraordinarily high drilling meterage which in 1952 totalled 473.5 kilometers, 120.7 kilometers thereof having been sunk in exploration wells and 91.4 kilometers in extension wells. There is little doubt that an output of two or even three million tons per annum will be attained within the next few years.

General view of the Ruchlermoor field near the Netherlands border showing newly constructed roads built to give access to the producing wells. Production of the field rose more than 50 percent in 1952 to an average of about 3,000 b/d.

TABLE I

GERMAN CRUDE OIL PRODUCTION IN 1952

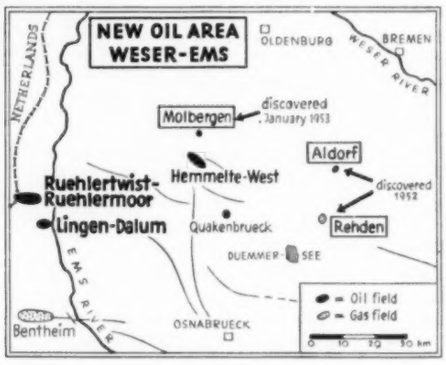
(Metric Tons)

	1951	1952
EMSLAND		
Adorf	804	411
Emlichheim	134,730	132,460
Georgsdorf	182,246	161,827
Lingen	98,591	137,938
Ruehlermoor	96,531	155,858
Ruehlertwist	67,753	113,735
Scheerhorn	20,888	55,259
	601,543	757,488
WESER-EMS		
Etzel	4,336	3,790
Hemmelte-West	727	34,278
Quakenbrueck	8,982	5,029
Aldorf	—	371
	14,045	43,468
HANNOVER		
Meckelfeld	2,296	2,076
Steimbke	96,611	98,150
Suderbruch	97,074	158,562
Eilte	247	188
Hademstorf	8,532	7,952
Thoeren	15,420	22,052
Wietze	29,172	27,898
Fuhrberg-Hambuehren	53,363	46,443
Nienhagen-Haenigsen	108,500	107,549
Wathlingen	9,103	12,625
Eicklingen-Wienhausen	9,441	9,257
Eldingen	47,189	95,721
Hohne	15,908	84,168
Wesendorf	85,556	88,194
Vorhop	—	23
Ehra	470	432
Gifhorn	1,863	1,945
Calberlah	814	681
Lehrte	—	261
Eddesse-Oelheim	4,549	14,609
Oberg	9,792	8,107
Moelme	4,027	3,188
Broistedt	5,308	4,446
Hohenassel	20,166	20,348
	625,401	814,875
SCHLESWIG-HOLSTEIN—HAMBURG		
Heide	72,002	74,036
Boostedt	—	7,002
Ploen	—	1,374
Reitbrook	47,459	50,701
	119,461	133,113
UPPER RHINE VALLEY		
Stockstadt	—	593
Forst-Weiher	2,515	2,495
Weingarten	3,704	3,385
	6,219	6,473
BAVARIA		
Tegernsee	16	13
Total	**1,366,685**	**1,755,430**

TABLE II

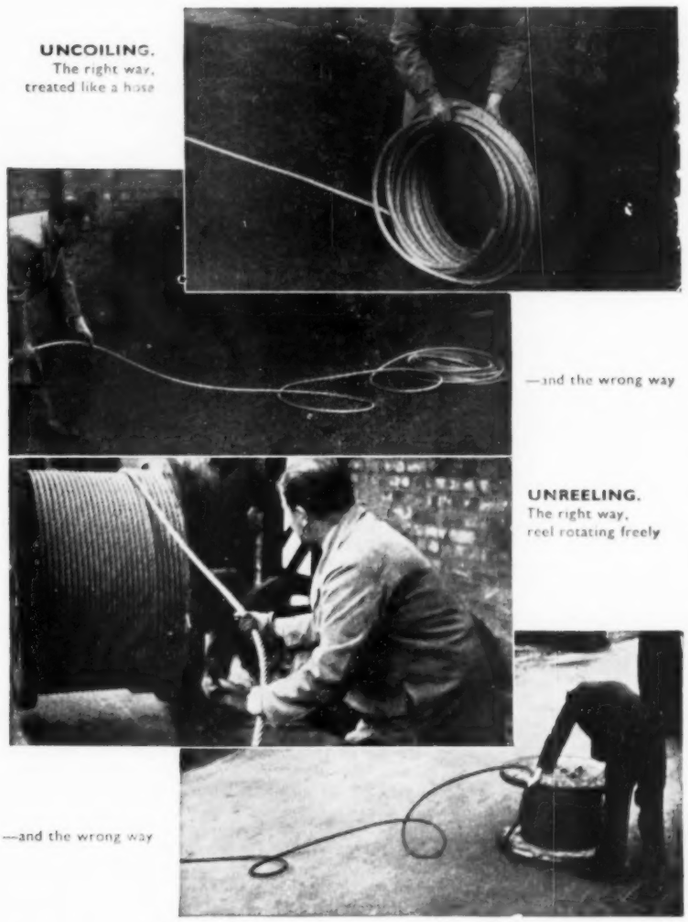
FOOTAGE DRILLED IN 1952

	1951	1952
Exploration wells	351,867¾	392,174¼
Extension wells	171,853½	297,043½
Development wells	790,861½	821,837¼
Service wells	—	27,865½
Total	**1,314,582¾**	**1,538,920½**



IF ROPE COULD TALK . . .

"I'm mighty like a hose!"



UNCOILING. The right way, treated like a hose

—and the wrong way

UNREELING. The right way, reel rotating freely

—and the wrong way

Good rope repays care in handling. Never allow kinks to form when UNCOILING or UNREELING a steel wire rope. Treat it like a hose pipe. A light coil of rope may be unrolled along the ground but should always be kept under control. A reel may be placed on a turntable or mounted on stands and supported by a bar or tube through the hole in its centre. In no case should a coil or reel be laid on the ground and the end taken over; kinks will inevitably form and the rope's life and efficiency be seriously reduced. When COILING down a rope always put in under-turns as required to counteract the tendency of the rope to twist itself. Under-turning is simple — the rope itself will indicate that.

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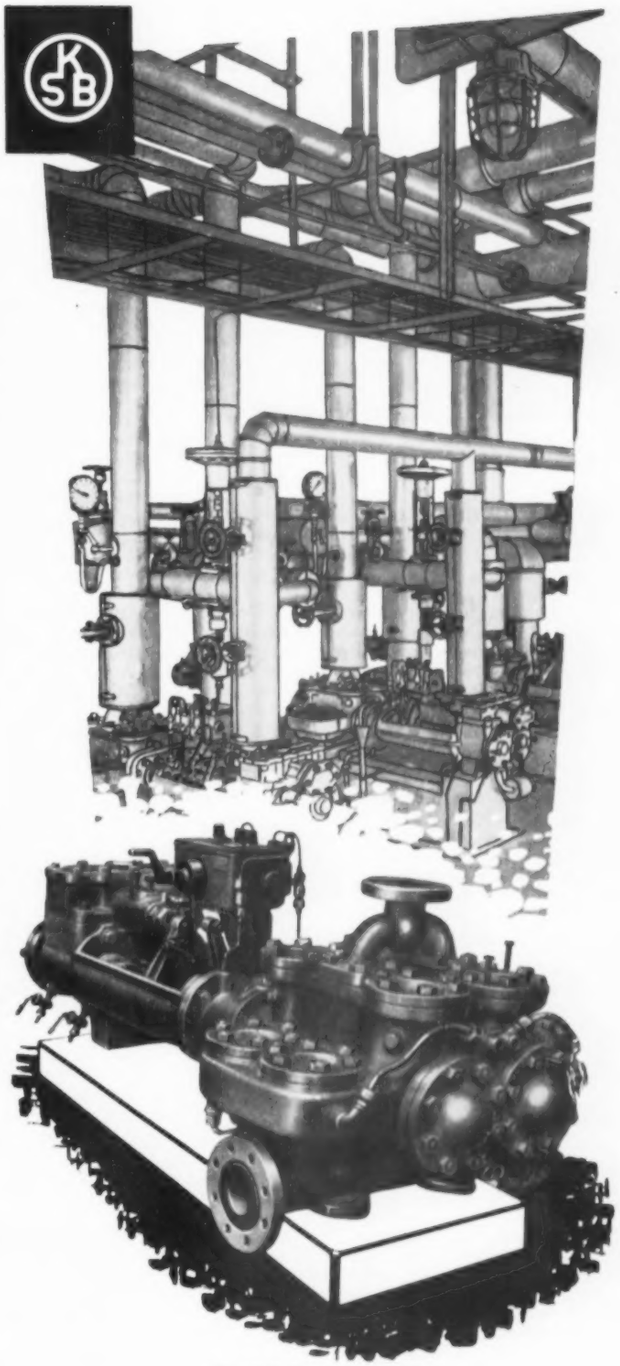

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J. E. Hughes

J. EDWARD HUGHES has been appointed secretary of Shell Oil Company of Canada, Ltd., it is announced by W. M. V. Ash, president. Mr. Hughes remains in charge of Shell's legal department in Toronto.

A graduate of the University of New Brunswick, Mr. Hughes was in private practice before joining the Attorney-General's department in his native province. In 1944 he was appointed senior counsel in this department and held that post until joining the Shell organization.

Rockwell Promotions

M. J. Harper has been appointed vice president and H. Gottwald as eastern regional manager of sales and district manager of the New York district office of the meter and valve division of Rockwell Manufacturing Co. Mr. Harper has been in the meter and valve division of the company for over 30 years as district manager of the New York office, and until his new appointment, was regional manager of the eastern region, coordinating the activities of the Boston, New York and Philadelphia offices.

Mr. Gottwald joined Rockwell in 1928 as a sales engineer in the New York district. He then became assistant vice president of Rockwell international division, and in that capacity traveled extensively throughout all of the eastern hemisphere. For the past two years Mr. Gottwald has been general sales manager for the Nordstrom valve division.

Elected Bechtel Directors

Sidney M. Blair of Toronto and Donald L. Roberts of Vancouver have been elected directors of Canadian Bechtel Ltd. Both are vice presidents of the company, which is a subsidiary of Bechtel. Mr. Blair is also a vice president of Trans Mountain Oil Pipe Line Co.

Mr. Blair was born in Ontario. Prior to joining Bechtel in 1949, he had been engaged in the direction of manufacturing, engineering and research activities within the oil industry in England, the Caribbean area and in Canada. He was the author of the report issued by the Albertan Government early in 1951 on the Athabaska sands and today also is a consultant to the Albertan Government.

Mr. Roberts joined Bechtel in Edmonton in 1942. Late in 1950 he was placed in charge of preliminary reconnaissance, cost estimating, engineering, design, field surveys and construction planning of the Trans Mountain project and since August, 1951, he has been project manager.

Hughes Plans Major Expansion

A new three-year expansion program will increase the capacity of Hughes Tool Company's Houston plant approximately 40 per cent. The increased capacity of the plant will further boost the company's payroll of 5,000, now one of the largest in the Southwest.

Supertanker Joins Sun Fleet

Sun Oil Company's first supertankship, the *SS Delaware Sun*, joined the company's fleet January 31. Employees of the company, their families, and officials of communities in the vicinity of the fleet's home port at the company's big refinery in Marcus Hook, Pa. greeted the new 30,000-ton vessel in a day-long "open house."

The ship, in which are incorporated the latest designs for safety, economy of operation and crew comfort, is 615 feet long, carries 215,000 barrels of crude oil and has a speed of 16½ knots.

The vessel is the first of four super-tankers ordered by Sun Oil Co. from the Sun Shipbuilding & Dry Dock Co.

Innovations include unusual features for the comfort and relaxation of the crew; the latest devices to aid in ship disaster, such as electric winches for launching life boats; the newest navigational aids; and, in the all-electric galley, an automatic garbage disposal unit.

With a complement of 45 officers and crewmen, each man will have a private stateroom equipped with wash basin, desk, built-in bunks instead of old-style pipe-frame bunks, individual radio accommodations and recessed fluorescent lighting. Most staterooms have rubber tile flooring and are decorated in pastel colors.

The crew's recreation room is 18 by 38 feet, furnished in modern decor with large photo murals on the hardwood-panelled walls, drapes at the windows, rubber tile floor, modern furniture, a large combination radio-phonograph and game cabinets.

A built-in screen at one end permits showing of the latest motion picture films. This is a nightly feature on Sun Oil tankers, a custom started by the company several years ago.

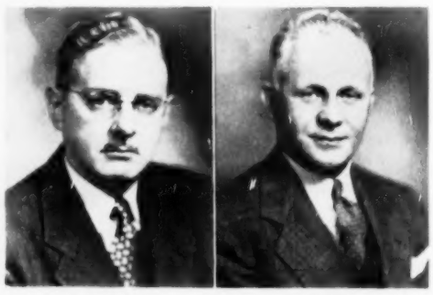
The Delaware Sun is the first steam-turbine vessel to join the Sun fleet in many years. Previously Sun has used diesels. It is the third tanker to bear the name of *Delaware Sun*.

Her aids to navigation include radar, Loran, radio direction finder, gyro compass and repeaters, magnetic compasses and echo sounding indicator.

Price Controls Removed

In pursuance of the announced program of the federal administration for discarding price controls, the Office of Price Stabilization announced the removal, effective February 13, of price regulations governing natural gas, crude oil and all petroleum products except No. 2 fuel oil. Because of its general use in domestic heating, this control is retained temporarily, but is expected to go into the discard as soon as the season of heavy consumption nears its end.

M. W. Kellogg Appointments



R. V. Becknell *O. G. Melchior*

R. V. Becknell has been appointed manager of the project engineering department of the M. W. Kellogg Co. and O. G. Melchior associate manager. Mr. Becknell and Mr. Melchior were formerly Kellogg project managers. Mr. Becknell will serve as administrative head of the department and in addition will be technically responsible for the project engineering on all company contract work in North, South and Central America. Mr. Melchior will be technically responsible for activities on European contracts. G. H. Branscombe and N. W. Lewis, formerly job engineers, were appointed project engineers.

Dr. D. M. Morrison

DR. D. M. MORRISON has been appointed manufacturing manager of Shell Oil Company of Canada, Ltd., on his return to the company from his post as director of the Petroleum Division, Department of Defense Production. Dr. Morrison will have headquarters in Toronto and will direct Shell's manufacturing operations throughout Canada including the Montreal East refinery, the newly expanded Shellburn refinery on the west coast, the new petrochemical plant being completed at Montreal, and Shell's other manufacturing and processing installations.

GSI Offers Correspondence Training

As part of a continuous training program aimed at maintaining a high level of technical proficiency in its field crews, Geophysical Service Inc. is offering its personnel correspondence work covering the entire field of seismic exploration. Begun in October, 1952, on a strictly voluntary basis, the study program already has an enrollment of 30 students from GSI crews operating in the United States. From foreign operations, an additional 30 students with Geophysical Service International Corp., Geophysical Service International S.A., and Geophysical Service Inc., bring the total enrollment to 60.

Personnel enrolled are party chiefs, seismologists, and computers. The courses offered cover all phases of seismic exploration work, from surveying and chart construction to geology and interpretation of seismograms. Roy Fuller, GSI correspondence training director, is in charge of the program under supervision of E. J. Stulken, chief seismologist for GSI.

Schlumberger Promotions

Four new appointments to the Houston headquarters of Schlumberger Well Surveying Corp. have been announced by W. J. Gillingham, executive vice president. L. A. Allaud and H. A. Nystrom have been made technical assistants to the vice president, operations and general services; R. K. Thies, assistant to the vice president, personnel relations; and Clark Edgecomb, assistant to the sales manager.

Mr. Allaud is a native of France and joined SPE in Paris in March 1935. He served Surenco in South America for several years and since March 1952 he has been located in Fort Worth serving as assistant to the Northwest Texas area manager. Mr. Nystrom joined Schlumberger in 1937. He has been district manager in Michigan, Illinois, Louisiana and Texas.

Mr. Thies joined Schlumberger in 1939 and was in the United States Navy during World War II as a Lieutenant, seeing action in the Pacific theatre before being released in 1945. When he returned to Schlumberger, he was assigned to Shreveport and then Tyler as district engineer, where he stayed until his present appointment. Mr. Edgecomb joined Schlumberger in 1943 and has worked in both Long Beach and Ventura. He has been district engineer at Ventura since March, 1948.

The Wimpey Central Laboratory

is an organisation for scientific research, materials testing, and technical development in the building and civil engineering industry. It has four main divisions, SOIL MECHANICS, CONCRETE, BUILDING MATERIALS, AND ASPHALT. In this way, all aspects of construction are covered by an organisation with world-wide experience both in research in the Laboratory, and construction in the field. Foundation conditions are explored and analysed, excavation and soil compaction problems are investigated, prospecting surveys are made for constructional materials, concrete mixing and placing methods are studied, building materials are tested, new forms of building construction are investigated and developed, quality control is maintained in concrete and bituminous construction, field laboratories are equipped and staffed.

THE CENTRAL LABORATORY SPECIALISES IN *COMPLETE* SITE INVESTIGATIONS OF ALL ASPECTS OF BUILDING AND CIVIL ENGINEERING CONSTRUCTION AT HOME AND OVERSEAS.

Every Wimpey operation has behind it the full resources of Wimpey's Central Laboratory.

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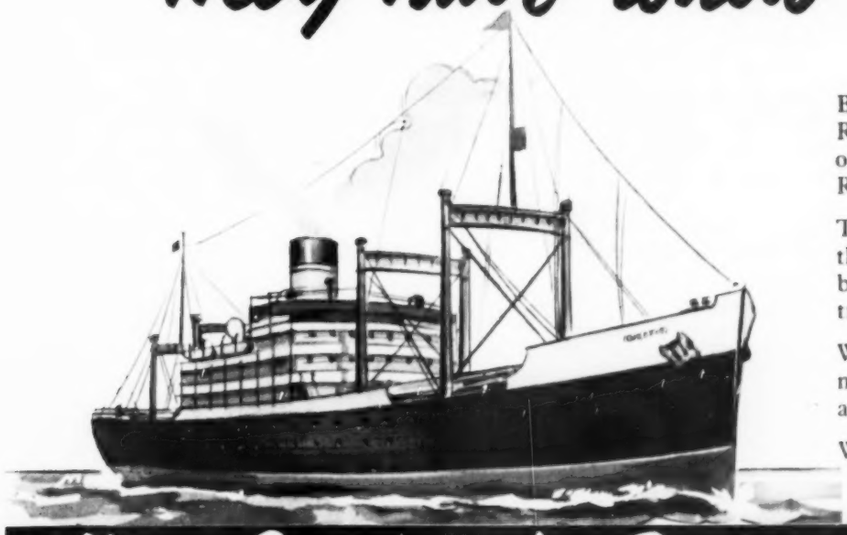

Beating round the Horn or storming along in the Roaring Forties was everyday work for the sailor of long ago; but wherever he went "Gourock" Ropes went with him—his trusted choice.

To-day, the men who man the merchantmen on the same sea lanes know very different conditions, but "Gourock" Ropes still go with them—*their* trusted choice.

With over 200 years of inherited skill backed by modern production methods, "Gourock" Ropes are the best—the obvious choice.

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Oil Recovery

(Continued from page 76)

Barnsdall Oil Company (now Sunray Oil Corporation) where water injection was commenced in 1946 and gas injection was commenced in 1947. Results of significant importance have been obtained from this project and it is indicated to be one of the most effective pressure maintenance projects in the United States.

As reported originally by Wharton and Kieschnick[11], and subsequently discussed by Griffith and Hollrah[12], it has been shown in both laboratory and field experiments that the injection of gas into oil reservoirs at pressures much higher than those used in most conventional gas pressure maintenance projects will result in considerably improved recovery of oil. In addition to employment of injection pressures in excess of 3,000 psi, it is indicated that recovery is improved by the injection of an appreciable quantity of intermediate boiling range hydrocarbons and by an undersaturation of the reservoir oil at the pressure of displacement. Improved recovery by the high pressure gas injection process is believed to be obtained as a result of:

(a.) reduction in reservoir crude oil viscosity.

(b.) swelling of reservoir crude oil to give a high formation volume factor.

(c.) evaporation and solution effects which reduce the final residual oil saturation.

Increase in the formation volume factor unquestionably is one of the most important and promising features of the high pressure gas injection process. By inducing a swelling of the crude oil to several times its original volume, the continuity of the oil phase in the reservoir is preserved, thus maintaining a high relative permeability to oil.

Unfortunately there are many shallow oil reservoirs in the United States which will not withstand the pressures required for the successful application of the high pressure gas injection process. Also, in many of the shallow producing areas, there are only limited quantities of LPG available. Consequently, recent studies conducted by Montclair Research Corporation for Oil Recovery Corporation on the effect of carbon dioxide on the solubility of natural gas hydrocarbons in crude oil are extremely significant.

Although an appreciable amount of data are available on the solubility of natural gas in various crude oils at elevated pressures, up to the present little information has been available on the effect that carbon dioxide has on the solubility of methane, ethane, and other gaseous hydrocarbons in crude oil. Data developed by Montclair on the solubility of carbon dioxide, methane, and ethane in Pennsylvania Grade Crude oil at 80°F are shown in the accompanying illustration, Figure I. In this figure the total solubilities of mixtures of carbon dioxide and ethane or methane in Penn Grade crude oil at the final equilibrium pressure are shown by Curves II and IV. For the carbon dioxide-ethane mixture of 1.50:1.00 partial pressure ratio (Curve II), the 900 psi pressure point corresponds to a carbon dioxide partial pressure of 540 psi and a methane partial pressure of 360 psi.

From the figure it can be seen that the solubility of methane is practically a straight line function over the pressure range examined. The carbon dioxide data are interesting in that while the solubility increases gradually over the range of from 100 to 500 psi in a straight line fashion, a rather sharp increase in the slope of the solubility curve occurs at the 600-700 psi pressure point. Above this inflection point the solubility of carbon dioxide increases rapidly with increasing pressure. The solubility of ethane increases rapidly with increasing pressure with the result that at a pressure of 500 psi the solubility is as much as 232 volumes of ethane for one volume of the crude oil.

From these curves it will be apparent that the use of carbon dioxide to increase the solubility of gaseous hydrocarbons in crude oil has important possibilities in various oil recovery processes. It is believed to be generally true that formation volume factors of reservoir crude oils are directly proportional to the volumes of gas dissolved. In contrast, as shown in the solubility curves, at a pressure of 900 psi, where the solubility of methane in the crude is only 30 volumes per volume of oil, the solubility of the CO_2-CH_4 mixture at a partial pressure ratio of 1.54:1.00 is 70 volumes per volume of oil. The total solubility of the CO_2-C_2H_6 mixture at approximately the same partial pressure approaches the exceedingly high value of 440 volumes per volume of oil. This phenomena should be of particular interest both in primary and secondary production operations since the addition of carbon dioxide would so increase the solubility of the hydrocarbon gases that their release from solution, as the pressure in the reservoir is reduced, would be greatly retarded.

In this connection, it should be noted that the application of carbonated water (the Orco process) to oil reservoir rocks invariably has resulted in the production of mixtures of carbon dioxide and abnormal quantities of hydrocarbon gases heavier than methane. Thus, the produced gas from an application of the Orco process should prove to be an ideal mixture to promote a high degree of reservoir fluid swelling. Once a cycle of use is established, the combined effects of carbon dioxide, when mixed with hydrocarbon gases and then dissolved in the reservoir crude in advance of the injection of carbonated water (a preconditioning process), as it is employed in the Orco process could prove to be a remarkably effective technique for improvement of recovery.

Although the data presented are based only on tests in which Pennsylvania Grade crude oil has been used, the possible application to crude oils possessing much higher viscosity is obvious. If, for instance, at a pressure of less than 1,000 psi, it is possible to bring about a solution of around 500 volumes of a CO_2-C_2H_6 mixture in one volume of crude oil, equivalent to around 2,800 cubic feet of the mixture in one barrel of stock-tank crude, this amount of gas in solution could be expected to approximately double the volume of the crude as it may have existed in a reservoir depleted of its original natural pressure. In addition, the solution of this amount of gas could be expected to decrease the viscosity of the oil to less than 10 percent of the viscosity of the dead crude oil. It is indicated, therefore, that by mixing carbon dioxide with light hydrocarbon gases the same effects can be produced at from a quarter to a third of the pressure required for the high pressure gas injection process and without the need for appreciable quantities of intermediate boiling range hydrocarbons.

Techniques and methods that have been discussed or proposed in preceding sections of this paper will serve to increase the efficiency of oil recovery processes because they will improve the mobility ratio. Other methods for improving oil recovery that have been receiving a great deal of attention in the past few years have been directed to a reduction in capillary pressure in the more minute pore openings of reservoir rocks by reduction of interfacial tension between the liquid phase, and to an alteration of the interfacial tension between the liquid phases and the solid, thus affecting the preferential wettability of the solid surface to either oil or water. The two chemical methods which have been applied recently with encouraging and in some instances quite positive results are the Orco process and the application of the Orchem combinations of various Armour surface active chemicals. The details of these methods and some of the results that have been obtained by their application have been discussed adequately by James W. Martin[13,14], and by the writer[15] and his colleagues[16], and need not be repeated. There are, however, some additional information that is not contained in these papers that is deserving of brief review.

Expansion of application of the Orco process was curtailed seriously by an unfavorable report from the laboratory of the Pennsylvania Grade Crude Oil Association which was presented at the Fifteenth Technical Conference on Petroleum Production at State College, Pennsylvania, October, 1951. The negative results reported in this paper were based on tests performed on only three sand samples. One of the samples was obtained from an outcrop of a sandstone that contained no natural oil saturation. The other

(Please turn to page 108)

DU PONT REG U.S. PAT. OFF.

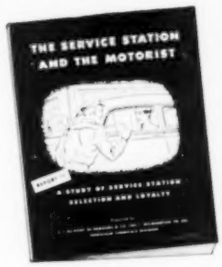
PETROLEUM CHEMICALS DIVISION

NEWS

DU PONT REG U.S. PAT. OFF.

March ★ One of a Series of Interest to the Petroleum Industry ★ 1953

Consumer Buying Trends Reported In New Booklet



The first report based on the Du Pont survey of service station customer buying habits is now off the press.

It is an authoritative study showing *why* motorists select certain service stations . . . and remain loyal to certain stations. As such, this report will be of considerable value to gasoline marketers in planning sales and promotion programs.

Copies are now being distributed to oil company marketing groups through the Du Pont Petroleum Chemicals Division district offices. Report No. 2 on brand name recognition and loyalty will be ready for distribution late in April.

To Guard Against the Effects of Copper Contamination — an "Insurance Policy"

Even when gasoline leaves the refinery entirely free of copper, it often ends up at the service station or in a customer's car with traces of copper present.

The trouble can generally be traced to the distribution system. All of these systems contain valves, pumps and various fittings which may be potential sources of copper contamination.

Today, consumer interest in gasoline quality is greater than it has been in many years. Your *at-the-pump* quality, therefore, can be an important competitive factor.

COSTS LESS THAN $2 PER 1,000 BARRELS

Refiners can be sure their gasolines are free from the harmful effects of copper contamination with Du Pont Metal Deactivator. The cost is less than $2 per 1,000 barrels.

Du Pont Metal Deactivator is specially formulated to offset the effects of copper in gasoline. When copper is present—from any source—the desired stability can generally be obtained more economically with the aid of small amounts of Metal Deactivator rather than with antioxidants alone.

New Fuel Oil Additive Offers Many Advantages

Both dispersing and stabilizing properties combined in new additive developed by DU PONT

Many customer complaints on plugged filters, screens and fuel lines may now be eliminated through the use of a new additive.

Known as *Fuel Oil Additive No. 2*, it was developed by DU PONT as a dispersant and stabilizer for distillate fuel oils.

MANY CUSTOMER COMPLAINTS, caused by such conditions as this clogged oil burner filter screen, can be eliminated with Du Pont Fuel Oil Additive No. 2.

Distillate fuel oils tend to deteriorate during long-term storage. As a result, both soluble and insoluble residues are formed. The soluble residues are not particularly harmful. The insoluble ones, however, cause plugging of lines, screens and filters in the fuel systems of domestic oil burners and diesel engines.

The usual oxidation inhibitors used in gasoline, greases and lube oils have very little stabilizing effect on fuel oils. Although there are several methods of stabilizing distillate oils — such as clay filtration and caustic extraction—many of these oils have proved very difficult or expensive to stabilize.

ELIMINATES MANY COMPLAINTS

The new Du Pont Fuel Oil Additive No. 2 not only retards the formation of insoluble residues; but also reduces the particle size of those insoluble residues that are formed. In this way it practically eliminates the possibility of complaints due to clogging.

This makes it possible for a refiner to blend catalytic cracked stocks with

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

PETROLEUM CHEMICALS DIVISION
NEWS

CONTINUED *New Additive*

his straight-run product without sacrificing stability in the blend.

SEASONAL FLEXIBILITY

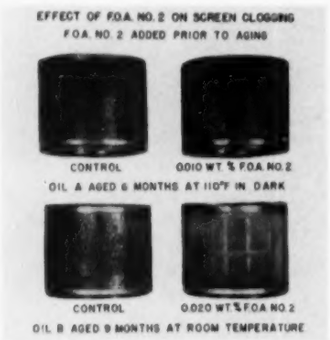
Marketing a blend of straight-run and catalytic cracked fuel oil has several advantages to the refiner such as:

1. Greater flexibility to meet peak seasonal demands.
2. Increased yield of domestic heating oils.
3. Release of straight-run stocks for sale as a premium diesel fuel or for use as charging stock.

Being ashless, Fuel Oil Additive No. 2 is particularly suitable for use in blended fuels for diesel engines.

HIGHLY EFFECTIVE

In all the types of fuels so far tested at the Du Pont Petroleum Laboratory, Fuel Oil Additive No. 2 gives desired results at a low cost because of its extremely high effectiveness.


EFFECT OF F.O.A. NO. 2 ON SCREEN CLOGGING
F.O.A. NO. 2 ADDED PRIOR TO AGING
CONTROL
0.010 WT. % F.O.A. NO. 2
OIL A AGED 6 MONTHS AT 110°F IN DARK
CONTROL
0.020 WT. % F.O.A. NO. 2
OIL B AGED 9 MONTHS AT ROOM TEMPERATURE

THIS PHOTO of four filter screens shows clearly the improvement in two oils to which Du Pont Fuel Oil Additive No. 2 has been added.

This new additive does not affect the color of the product in any way. It can be easily added—either directly from the drum or in a special kerosine solution to decrease viscosity.

SAMPLES AVAILABLE

Refiners who are interested in testing Du Pont Fuel Oil Additive No. 2 should get in touch with their local Du Pont Petroleum Chemicals Division representative for samples and full details.

Heads Central District Laboratory

Twenty years in petroleum research

DR. AUSTIN B. WILDER, laboratory manager in the Du Pont Petroleum Chemicals Division central district, has been engaged in petroleum research work for more than 20 years.

He joined Du Pont in 1947, after 14 years as a research chemist with the Pure Oil Company. Before this he was engaged in fuel research work for the General Motors Research Corporation in Detroit.

Dr. Wilder studied at Berea College. He received his B.S. and M.S. degrees in chemistry at Ohio State University and later received his Ph.D. degree in organic chemistry at the University of Chicago.

DR. AUSTIN B. WILDER

Fellowships to Advance Teaching of Chemistry Awarded by Du Pont

A new program to assist American colleges and universities in the teaching of chemistry will be begun by the Du Pont Company next fall. It provides for new fellowships or grants to 32 institutions during the next academic year.

The program includes two separate plans. Under one plan, grants have been made to 19 private colleges to help them maintain their outstanding performance in training students majoring in chemistry. The other provides postgraduate fellowships at 13 universities to improve the teaching of chemistry to undergraduates.

The need for such assistance was revealed in a comprehensive survey done by the company. Commenting on the new program, Crawford H. Greenewalt, president of the company, said, "The maintenance and encouragement of high-quality teaching is vital to the future supply of scientists and consequently research."

Decisions on detailed use of the funds are being left up to the institutions selected.

MOVIES AVAILABLE

Prints of the following Du Pont films are available to oil companies for training and public relations purposes. They may be borrowed or purchased. Address request to nearest Petroleum Chemicals Division district office.

Pipeline on Wheels—A 26-minute, full-color movie on tank truck safety. Suitable for both training and public relations purposes.

What Makes a Gasoline Good—An 18-minute cartoon movie in color. Presents the story of how high quality gasoline is made in easy-to-understand form. Ideal for dealer training meetings.

In addition to the above, Du Pont makes available a special library of films of particular interest to the petroleum industry.

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. . . through Chemistry

Petroleum Chemicals

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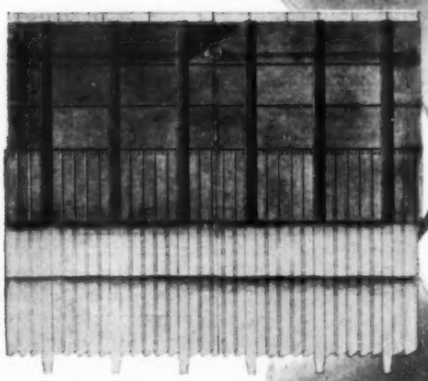
a true test of quality is endurance

IN 1833 the Birtley Iron Company, as it was then known, supplied Cast Iron Piling to the Port of London Authority, for the Brunswick Wharf, Blackwall. This illustration is an actual photograph of a section of that original piling, removed in 1949 during the construction of Brunswick Wharf Power Station.

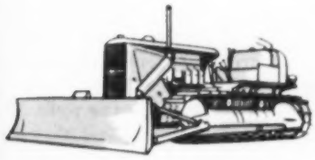


IRON WHARFING AT EAST INDIA DOCK, BLACKWALL

* This information was made available through the courtesy of the Chief Engineer to the Port of London Authority, W. P. Shepherd-Barron, M.C., T.D., M.Inst.C.E.

AFTER 119 YEARS

at the Birtley Co. Ltd., today the *same* inherent skill and craftsmanship is being applied to the production of Precision Welded Fabrications. Some typical examples are Earthmoving Equipment to withstand the most arduous field conditions, Marine type Gear Cases, Condenser Shells, Multi-cylinder Marine Diesel Engine Frames, etc., etc.



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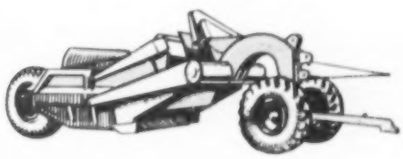

THE BIRTLEY COMPANY LTD COUNTY DURHAM ENGLAND

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Rooster 2554

Oil Recovery

(Continued from page 104)

two were from the Venango sand series which have not responded successfully to water-flooding. To those who were familiar with the specialized techniques required for laboratory oil recovery tests with carbon dioxide, the results obtained by the Penn Grade Association were not surprising, particularly since by no means all oil recovery tests with carbonated water are uniformly successful. Nevertheless, the unfavorable publicity that resulted from the publication of the laboratory work of the Penn Grade Association had a discouraging influence on plans for field applications of the Orco process that were receiving active consideration at that time.

Subsequently, in a very forthright reversal of its previous findings, the production research laboratory of the Pennsylvania Grade Crude Oil Association at the Sixteenth Technical Conference on Petroleum Production, at State College, Pennsylvania, October 22-24, 1952, reported that much more extensive and properly conducted laboratory tests indicated that the use of carbon dioxide solutions in water flooding would yield a higher recovery of oil than plain water alone. The results of the more recent tests were so favorable that a large scale field test has been recommended by the Penn Grade Association laboratory.

Much of the criticism that has been directed to the Orco process seems to be based on a lack of complete understanding of the mechanism of the process, which Martin[14] and the writer[15] have admitted repeatedly. The fact that the nature of the reaction between carbon dioxide and hydrocarbon compounds, whether it be physical or chemical, is not known completely is not astonishing. Each year, under the influence of solar energy, plants synthesize their complex organic constituents from carbon dioxide as the only source of carbon, from water, and from inorganic salts derived from the soil. Although the phenomenon of photosynthesis is the most important reaction in the life cycle of all living organisms, its exact nature remains unknown even though it has been the subject of intense scientific investigation. Nevertheless, it is a notable fact that even though farmers do not understand how carbon dioxide combines itself with water to form edible carbohydrates, they are not deterred from planting every year the wheat and other grain crops that are essential for the existence of the human race. When it is recognized that photosynthesis utilizes two of the most simple molecules, it should not be difficult to appreciate that the possible reaction between carbon dioxide and much more complex molecules of carbon and hydrogen may be much more complicated, and correspondingly much more difficult to determine.

Those who have been connected with the discovery and development of the Orco process are very conscious of the fact that it cannot be applied with equal measures of success in all fields; also, that its application will be limited in some cases by economic factors as well as by unfavorable reservoir conditions. Nevertheless, the evidence available at this time indicates impressively that the Orco process has reached a stage of development that should enable it to play an important part in improving the efficiency and economy of recovery in many of the world's oil fields.

Many of the uses for surface active chemicals for the improvement of recovery or to increase the efficiency of oil production that were suggested by the writer[15] at the 1951 Annual Meeting of the American Petroleum Institute are now realities. Synergetic use of two or more surface active chemicals has proved to be far more effective than the use of single compounds or more than one compound in succession. Such combinations of non-ionic compounds or non-ionic and cationic compounds have proved to be effective in field tests as bactericides and corrosion inhibitors, to control the hydration of clay minerals, to increase effective permeability to water, and in laboratory tests to increase the recovery of oil. The evidence so far developed shows convincingly that the most effective application of surface active chemicals will be during the initial stage of water injection. Also, the evidence is indicative, although not positively conclusive, that non-ionic compounds are most effective in releasing oil from hydrophobic surfaces. Laboratory work on reservoir material believed to possess hydrophilic tendencies has resulted in little or no increase in oil recovery.

It is becoming more and more evident that the non-ionic compounds, which do not ionize in water solution and which are soluble in water because of their unionized polar groups, are the most effective in lowering the interfacial tension between oil and water and in altering the interfacial tension between the liquid phases and the solid surface of the reservoir. The chromatography or adsorption-desorption phenomena of the non-ionic compounds is receiving intensive study at the University of Texas. This work is not sufficiently advanced to provide any quantitative results. However, field results and qualitative laboratory tests indicate quite impressively that certain of the Armour non-ionic compounds are not adsorbed permanently but do come through the reservoir from water input wells to producing wells with little loss in concentration other than the dilution that is inevitable from the water that is already present in the reservoir.

As indicated previously, combinations of surface active chemicals are proving to be far more effective and economical than single compounds alone. The reasons for this synergetic action are not entirely understood, although it is known that some of the non-ionic compounds have much greater effect on liquid interfaces and others have much greater effect on the interfaces between the liquids and the solid. Many of these remarkable surface active chemicals are only recently available in more than laboratory test quantities, and only a few years ago they were little more than ideas in the minds of brilliant and resourceful chemists. Thus, it is obvious that we have much to learn about their practical application and their field performance. Nevertheless, they do have tremendous promise, and along with the Orco process it is believed that their application will have a very profound influence on future oil recovery practice.

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Aramco Field Operations

(Continued from page 67)

In 1951 the deliveries under these headings were:

Bahrain Petroleum Co.		
by pipe line	6,058,517	tons
Ras Tanura refinery	7,628,024	"
To tankships		
at Ras Tanura	8,836,042	"
To Sidon via Tapline	14,221,589	"

The crude shipped through Tapline and by tanker from Ras Tanura is stabilized in order to reduce corrosion, the maximum of sulfuretted hydrogen allowed in the stabilized crude being 10 parts per million, but at the writer's visit this was only running at five parts per million.

The unstabilized crude, after degassification at the separators, carries about 35/40 cubic feet per barrel of gas at atmospheric pressure.

There are three stabilizing units at the Dhahran stabilization plant, each having a nominal capacity of 160,000 b/d, but at the time of visit, only two were in operation.

The stabilization units are similar in design principle to modern topping units, the working temperature being the only difference in operation. Their main use is the elimination of the sulfuretted hydrogen dissolved in the crude oil, and the working temperature is regulated accordingly.

The inlet temperature when dealing with Abqaiq crude oil is 200° F, but the impurity is more difficult to remove from Dammam crude which requires an inlet temperature of 240° F.

The water treatment plant at Dhahran adjoins the stabilization plant and forms part of that section. Water is drawn from four wells, about 350 feet deep, each well giving 12-15,000 barrels per day. The water is brackish and has a high total solid content.

Employees working on a construction project at the Buqqa gas-oil separators are addressed by a safety technician speaking with the help of a sound truck.

An engine maintenance class at the training rig just outside of Dhahran, Saudi Arabia. Intensive training courses on the type of equipment they will handle on their jobs are given Saudi trainees.

The first step in the treatment is by Zeolite, this plant having a capacity of 450 U.S.A. gallons per minute. The hardness at this stage is reduced to 18-20 pts. The sodium chloride content is still high, but it can be used in the cooling towers and then fed to the evaporators.

The evaporators make 4,000 gallons of water per hour which is used for drinking and for boilers. In addition, they make 20,000 pounds of 165-pound pressure steam which goes to the camp for use in the air conditioning plant and for domestic purposes, while the condensate from these usages is then used for domestic purposes.

There are seven Riley water tube boilers with a total capacity of 205,000 pounds of 400-pound pressure superheated steam per hour.

The high pressure steam is used for large pumps and for the evaporators, the 165-pound steam from these being used for smaller pumps.

The boilers are fired with exhaust gas from the gas turbines, which is extracted at 50 pounds, as are the pipe still heaters for the crude to the columns of the stabilization plant. These turbines are driven by high pressure gas from the separators of the de-gasifying plants.

One of the most important phases of Aramco's activities is of course the operation of its big refinery at Ras Tanura which processes over 200,000 barrels daily of Arabian crude and is constantly undergoing expansion. A description of this great plant, together with its supply and shipping facilities, will be the subject of a separate article in a subsequent issue.

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A Shell photograph

Taking a reading of a Klinger Level Gage (Hubbard Patent) for liquefied gas installed in the refinery of the "Shell" Refining and Marketing Company Limited at Stanlow, Cheshire, England

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OIL COMPANY STAFF CHANGES

HORRY F. PRIOLEAU became president and chief executive officer of Standard-Vacuum Oil Co. January 1 to succeed Philo W. Parker who retired after more than 40 years in the international petroleum industry. A. W. Bourne, Jr., also retired as vice-president and director, and C. B. Marshall was made vice-chairman of the company's executive committee. The two retirements reduce the board's membership to nine.

Mr. Parker, an officer and director of Standard-Vacuum continuously since its formation in 1933, had been the company's chief executive officer for the past six years. After graduating from Colgate in 1912, he served for the next two decades in various marketing posts in the Far East, returning to New York in 1931.

Mr. Prioleau, who has been a vice-president since 1949, has had 31 years of experience in the international oil business. After occupying succesive posts in New York and Europe, including that of general manager at the Hague for Standard-Vacuum's producing and refining interests in Indonesia, he returned to New York in 1941 to join the Creole Petroleum Corp. He served as senior vice-president and director of that company before re-joining the Standard-Vacuum organization in 1949. Mr. Prioleau returned early in December from a round-the-world visit to the company's operating areas.

Mr. Bourne, a Stanvac director since 1947 and a vice-president for nearly three years, began his career as a marketer in Java 37 years ago. Subsequently he served at Singapore, London and Hong Kong. He was interned by the Japanese early in the war and was repatriated with the first group of Americans aboard the Gripsholm in 1942. Prior to the Communist regime in China, Mr. Bourne was general manager of the company's China division at Shanghai.

DR. M. E. SPAGHT has been appointed executive vice president of Shell Oil Co., a new position. As president of Shell Development Co. since 1949, he has been in charge of Shell research in the United States. Dr. Spaght joined Shell in 1933 as a chemist. Dr. Harold Gershinowitz has been appointed president of Shell Development Co., replacing Dr. Spaght. He has been head of the exploration and production branch of research and has been with Shell since 1938. Both men will make their headquarters in New York.

PAUL E. KUHL, assistant general manager of manufacturing for Esso Standard Oil Co., has accepted a one-year appointment as director of foreign refining for the Petroleum Administration for Defense. He will be succeeded in the interim by William F. Thiede, general manager of east coast manufacturing. H. G. Mangelsdorf, general superintendent of the Bayway refinery in Linden, New Jersey, will succeed Mr. Thiede.

Mr. Kuhl joined the company as a student engineer in 1926. He subsequently served as assistant superintendent of the Aruba refinery, associate manager of Standard Oil Development Company's process division and manager of Esso's southern east coast units. He was named assistant general manager of east coast manufacturing in 1948 and succeeded to his present position two years later.

Mr. Thiede started with the company as a full-time employee in the oil movement and storage division at the Bayway refinery in 1912. He was made superintendent of the Bayonne Refinery in 1928, manager of the New Jersey works in 1945, and general manager of the east coast division in 1949.

Mr. Mangelsdorf joined the company in 1934 at the Baton Rouge refinery where he subsequently became manager of the chemical products division and later general superintendent of the petroleum products division.

H. F. Prioleau

C. B. Marshall

F. W. Bartlett

G. S. Dunham

H. Gershinowitz

M. E. Spaght

J. Oostermeyer

R. C. McCurdy

P. E. Kuhl

W. F. Thiede

FRED W. BARTLETT, general manager of the producing department, and George S. Dunham, vice chairman of the manufacturing committee, have been elected directors of Socony-Vacuum Oil Company, Inc. Wilbur F. Burt, vice president and director in charge of coordination, retired at the end of 1952 after 40 years of service.

Charles L. Harding, a director since 1948, was elected a vice president and member of the executive committee. Clark S. Teitsworth, a director since 1947, was designated to succeed Mr. Burt in charge of coordination, while Mr. Dunham was chosen to succeed Mr. Teitsworth as head of the manufacturing committee. All changes were effective January 1.

Mr. Bartlett joined Socony-Vacuum in 1939 after 17 years of oil experience in the United States and Mexico. He was appointed chief geologist of Socony-Vacuum Oil Company of Venezuela in 1940, holding that position until moving to New York as assistant chief geologist in 1943. Four years later Mr. Bartlett was made assistant to John C. Case, who is vice president in charge of production. Mr. Bartlett has been general manager of the producing department for the last three years.

Mr. Dunham's first job in the oil industry was as an assistant construction engineer in Parco, Wyo., shortly after his graduation from Cornell University in 1922. Three years later he became maintenance foreman at the Augusta, Kan., refinery of the White Eagle Refining Co., which is now a part of Socony-Vacuum. In 1936 he was named manager of Socony-Vacuum's refinery engineering division. As vice chairman of the manufacturing committee, he has had broad experience relating to the company's refineries in eastern and central United States.

JAMES M. GREER, counsel for South America and Europe of the Gulf Oil Corp., retired January 1 on the 33rd anniversary of his association with Gulf. From 1944 to 1946 Mr. Greer served in Venezuela as a director and executive vice president of the Mene Grande Oil Co., C.A. At the time of his retirement, he was a director of the Venezuela Gulf Refining Co. and an assistant secretary of Gulf Oil Corp. and of many of its subsidiaries.

JAN OOSTERMEYER, president of Shell Chemical Corp., will retire May 31 after 36 years of service with various Shell companies. He will be succeeded by R. C. McCurdy, now general manager of the Royal Dutch/Shell companies in Venezuela. Mr. Oostermeyer's career, which has embraced a wide variety of positions in many parts of the world, included more than 20 years in China. In 1939 he became assistant to the president of Shell Chemical, since 1929 a pioneer in the petrochemical field. In 1941 he became vice president, and in 1942, president. He will remain in an advisory capacity with the company until the end of the year.

ROBERT G. PARKER, who has been associated with Continental Oil Company's oil and gas production activities since 1939, has been promoted to production manager for Conoco's central region, with headquarters in Oklahoma City. His most recent assignment has been as assistant production manager of Continental's southwestern region at Fort Worth.

S. T. PRUITT, manager of the central sales region of Ethyl Corp., has been appointed director of the Rubber, Chemicals, Drugs and Fuels Division of the Office of Price Stabilization in Washington, D. C. During his six months' absence from Chicago, Stuart Forbes, assistant manager, will serve as acting manager.

Advanced Exploration Co., Inc.
Amerada Petroleum Corporation
Ayrshire Exploration Company
Bank of Mexico
Beaver Geophysical Services, Ltd.
Berg Geophysical Company
Brazos Exploration Service
Broussard Exploration Co., Inc.
California Standard Co., The
Canadian Gulf Oil Company
Delhi Oil Corporation
Donnally Exploration Company
Donnally Geophysical Company
Donnally Seismograph Company
Electronic Logging and Velocity Co., Ltd.
Empire Geophysical, Inc.
Evangeline Seismic Company
Farney Exploration Company, Ltd.
Fenwick-Walczak Company
Frontier Geophysical, Ltd.
Geochemical Surveys
Geocraft, Ltd.
Geophysical Associates
Geophysical Prospecting Co., Ltd.
Gulf Oil Corporation
Heard Exploration Company
Hooks Exploration Company
Humble Oil & Refining Company
Independent Exploration Co.
Inter-American Geophysical Co., Ltd.
Japanese Government
Kerr-McGee Oil Industries, Inc.
Louisiana Oil Exploration Co.
Mayes-Bevan Company
McCollum Exploration Company
Midwest Exploration Company
Montex Exploration Company
Nance Exploration Company
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Northwest Seismic Surveys, Ltd.
Pan American Geophysical Co.
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Plymouth Oil Company
Portable Seismograph, Inc.
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Seismograph Service Corporation
Seismic Ventures Limited
Seismotech, Ltd.
Sinclair Oil & Gas Company
Sinclair Research Laboratories, Inc.
Sohio Petroleum Company
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Subsurface Exploration, Ltd.
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Unger Exploration Company
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FREDERIC R. PRATT, general manager of the marine transportation department of Socony-Vacuum Oil Co., Inc., has been appointed chairman of the company's coordination committee, succeeding A. H. DeFriest.

Parker S. Wise, formerly Mr. Pratt's assistant, succeeds Mr. Pratt. J. M. Hillcoat, manager of the department's traffic division, has been named assistant general manager of the department succeeding Mr. Wise, and Herbert A. Steyn, Jr. replaces Mr. Hillcoat.

Mr. Pratt became a clerk of the marine transportation department in 1930. He was appointed general manager of the department in 1946. Mr. Wise has been manager of the inland waterways division, assistant manager of the traffic division and assistant general manager of marine transportation. Mr. Hillcoat joined the company in 1923 as general assistant of deep sea fleet operations. He was named manager of the marine transportation traffic division in 1945.

N. D. SMITH, JR. has been appointed director of the exploration and production research division of Shell Development Co., Houston. He joined Shell in 1935 as a seismologist in Tulsa. In 1945, after a three-year leave of absence for service with the Naval Ordnance Department, he was appointed manager of the physical department in Shell's exploration and production research laboratory in Houston. He has been manager of the laboratory since 1947.

C. M. HARTWELL, who has just returned from service in the armed forces, has been named district superintendent for the oil production division of Cities Service Oil Co. at Hobbs, N. Mex. He will have charge of the oil production properties formerly handled by R. W. Ely, who becomes assistant to D. D. Bodie, division superintendent of all West Texas-New Mexico operations. He, too, will be headquartered at Hobbs.

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O. V. Tracy

OSGOOD V. TRACY, general manager of the chemical products department of Esso Standard Oil Co., has been elected president of Enjay Company, Inc., a sales affiliate marketing petroleum chemicals nationally. Mr. Tracy will retain his position with Esso. He succeeds John A. Britton, Jr., president of Enjay since 1948, who plans to retire during 1953, but will continue as a director and advisor on sales until his actual retirement.

Mr. Tracy has recently returned from a leave of absence as director of the chemical division of the National Production Authority in Washington, D. C. He has been a director of Enjay and was formerly operations head of Standard Oil Development Co. and manufacturing coordinator of chemical products for Esso.

Mr. Britton, perhaps one of the best known figures in the petrochemical marketing field, has been associated with Esso and affiliated companies since 1920 and subsequently became head of additives (Paramins) and synthetic rubber sales.

J. B. SUTHERLAND, Los Angeles division manager of The Ohio Oil Co. since 1941, was appointed assistant to W. B. Emery, manager of production, on January 1. Mr. Sutherland will remain in California on special assignments for Mr. Emery. George Sowards, chief petroleum engineer at Findlay, Ohio, succeeded Mr. Sutherland as Los Angeles division manager.

E. P. Ward, assistant to the manager of production at Findlay, was appointed chief petroleum engineer, and I. G. Burrell, division superintendent at Terre Haute, Ind., became assistant to the manager of production at Findlay. N. E. Trumbull, district petroleum engineer at Bakersfield, Calif., has been appointed division superintendent at Terre Haute, and J. H. Shonk his assistant.

CHARLES B. DUKE has been made manager of the refinery supply and distribution division of Sun Oil Company's manufacturing department to succeed Donald Lincoln who died last month. Edwin H. Sampson, Jr., has been appointed assistant manager of the division in charge of supply, and Wirt R. Robinson assistant manager in charge of distribution.

E. R. SMITH has transferred to the marketing coordination department of Standard Oil Co. (N.J.) as area contact representative for the North American and Caribbean affiliates. He has been manager of marketing for The Carter Oil Co. C. D. Hill, of Denver, who has been Mr. Smith's assistant, became manager of marketing for Carter March 1.

J. R. MC WILLIAMS, vice president of Carter Oil Co.'s northwest division, Denver, has resigned and will enter private business in Tulsa. During World War II he served a year in Washington, D. C., as director of the production division of the Petroleum Administration for War. Mr. McWilliams' successor has not been named.

M. F. Braeckel

MARC F. BRAECKEL, formerly manager of wholesale sales, has been appointed general domestic sales manager of Sinclair Refining Co. Charles R. Campbell becomes manager of wholesale sales to succeed Mr. Braeckel and H. D. Moore becomes assistant manager.

Mr. Braeckel joined the Richfield Oil Corp. of New York in 1930 and in 1948 was elected president of that company. He was named assistant general sales manager of Sinclair Refining Co. in March 1949, continuing as president of Richfield also until 1951. He was elected a vice president of Sinclair Refining Co. and named manager of wholesale sales in May 1952.

D. BROCKETT, JR., formerly chief of the exploitation and engineering branch of the reduction department of Gulf Oil Corp., has been appointed assistant to the general manager of Mene Grande Oil Co. His headquarters will be in Caracas, Venezuela. He is succeeded at Pittsburgh by L. G. May, who was Mr. Brockett's assistant. Mr. May will act as an advisor to the vice president of the production department on matters of drilling, production and engineering.

Mr. Brockett was production engineer at Odessa, Texas, when he was called to military service in the United States Army as a 1st Lieutenant in 1940. He was discharged as a Colonel in 1945.

Mr. May joined Gulf in 1938 as a roustabout. He was a lieutenant in the United States Navy from 1942 to 1946. In 1947 he was transferred to the Kuwait Oil Company, Ltd., and served as resident geologist and reservoir engineer for that company until 1949, when he was made chief petroleum engineer. In 1950, he was made superintendent of production for the Kuwait company and served in that capacity until 1952, when he was transferred to the production department of Gulf in Pittsburgh.

MARY EMERICK, Standard Oil Co. of California public relations department, has been elected a director of the Desk and Derrick Club of San Francisco and appointed second vice president. She succeeds Rosemary Goodrich of Shell Development Co., Emeryville, who has been transferred by Shell to New York. Carol Hoadley of Tide Water Associated has just been appointed recording secretary of the club to fill a vacancy caused by the resignation of Fay Avlon of Union Oil Co. of California.

JOHN G. CAMPBELL has been named general sales manager for Deep Rock Oil Corp. He has been head of Deep Rock's supplies and economics division since joining the company in 1948. William M. Murray continues as general products sales manager.

A. F. RYAN has been appointed Ethyl Corporation district manager in Denver, Colo., a new position in the Ethyl sales organization. Mr. Ryan has been an account representative in Kansas City for the past two years. He joined Ethyl Corporation in 1941.

E. C. MICHELS, Ponca City, Okla., pipe line engineer for Continental Pipe Line Co., has been promoted to superintendent of Pioneer Pipe Line Co., with headquarters in Salt Lake City, it has been announced by J. W. Liddell, president of Pioneer Pipe Line Co. and vice president and Rocky Mountain region general manager for Continental Oil Co. Pioneer Pipe Line Co. is owned 65 percent by Continental Oil Co. and 35 percent by Sinclair Pipe Line Co.

Mr. Michels will supervise operation of Pioneer Pipe Line Company's new 291-mile, 8-inch products pipe line from Sinclair, Wyo., to Salt Lake City. The 12,000-barrel Pioneer system was completed in January at a cost of about $8,000,000. The line connects in Salt Lake City with Salt Lake Pipe Line Company's 8-inch products pipe line, which extends to Pasco, Wash., and enables Conoco to make deliveries of petroleum products to terminals at Boise and Burley, Ida., and Pasco.

W. C. STOUT, Houston, southern region exploration manager for Continental Oil Co., has been promoted to assistant manager of the land section, headquarters exploration department. He will continue to make his headquarters in Houston and will be associated with W. E. Haggard, manager of Conoco's land section.

E. W. Kimball, Houston, regional geologist for the southern area, was promoted to southern region exploration manager, succeeding Mr. Stout.

R. T. Short, Corpus Christi division geologist, was promoted to regional geologist for the southern area, succeeding Mr. Kimball. He will make his new headquarters at Houston.

O. H. BERRY, JR. has joined Vickers Petroleum Co. as chief engineer to supervise deep drilling operations. Mr. Berry resigned from Wilshire Oil Co. to join Vickers. He formerly was division engineer with Standard Oil Co. of Texas.

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INTERNATIONAL NEWS AND NOTES

Court Holds Iran's Oil Seizure Invalid

First court decision in a legal test of Iran's sale of oil produced by Anglo-Iranian Oil Company and claimed by the company as its property was handed down by the Supreme Court of Aden early in January and supported the company's claim.

The case involved 900 tons of crude oil shipped from Persia in June last on the small tanker *Rose Mary* chartered by the Budenberg Co. representing Italian interests. When the *Rose Mary* put in at Aden last summer, it was promptly libeled by representatives of the AIOC and the case has been pending since that time. In its decision, the court said that it must refuse to recognize the validity of the Iranian oil nationalization law so far as it related to the property of the plaintiffs.

According to a dispatch from Rome, Count Ettore Della Zonca, representing the Epim Oil Co., reputed purchaser of the cargo, stated that the decision would be appealed.

Dr. Alcala Sucre Promoted

Dr. Luis Alcala Sucre, who has represented the employers' point of view for the Venezuelan oil industry in international conferences, has been promoted to assistant advisor for industrial relations of Mene Grande Oil Co., Gulf subsidiary in Venezuela.

Dr. Alcala Sucre has been with Mene Grande most recently as director of safety, education and training, since 1937. He took his pre-university education in Venezuela, Germany, France and the United States. He graduated as a chemical engineer from the University of Southern California in 1933, was employed with Engineering Products Co. until 1937, and then returned to Venezuela.

Beginning as an engineer in dehydration and demulsifying plants, Dr. Alcala Sucre rose through a series of petroleum engineering jobs to become chief petroleum engineer of Mene Grande's operations in Western Venezuela. At his own request, he was transferred to Caracas headquarters in 1946 and shortly afterward took charge of safety, education and training.

Dr. Alcala Sucre has represented Venezuela at conferences in Los Angeles, Geneva, Montevideo and The Hague. In October 1952, he went to Holland as a delegate to the Fourth Conference of the Petroleum Committee of the International Labor Office, and was elected chairman of the employers' group, composed of delegates from 14 participating countries.

Dr. L. Alcala Sucre

Venezuela Gas-and-Gasoline Projects

Several gas-and-gasoline projects are planned for Eastern Venezuela. Creole (as operator), Mene Grande, Socony and Pantepec will participate in construction of a combined natural-gasoline and crude-stabilization plant in the San Joaquin area of Eastern Venezuela, to be placed in operation in 1954. The plant will process 65 million cubic feet of gas and 25,000 b/d of oil. Hudson Engineering Co. of Houston won the engineering-design award.

Chicago Bridge and Iron Co. is now building a gasoline plant adjacent to Mene Grande's West Guara compressor plant. This new unit will process about 40 million cubic feet of gas, recovering about 1,600 barrels per day of natural gasoline. The plant will be ready by the end of the first quarter of 1953.

Mene Grande (as operator), Creole and Socony are about to award the construction bid for erection of a combined gas-injection and gaslift-compressor plant for the Chimire field. Between 35-40 million cubic feet per day will be processed, most of it to be returned to the formations for pressure maintenance, with the remainder used to lift production from dead or weak wells in the field. Another Chimire project in the planning stage covers a natural gasoline plant for Chimire to process all the gas handled by the compressors, thereby recovering about 1,000 barrels per day of natural gasoline.

A water-injection project maintains pressure in the West Guara field operated by Meneg. This operation, begun in 1948, has injected 3.5 million barrels of salt water (obtained from a nearby wet-oil treating plant) through two wells located in the water leg of the D-4 sand. Injection currently continues at about 2,500 barrels per day. Of West Guara's current potential of 36,000 barrels per day, over 21,000 comes from pressure-maintained reservoirs, and some 80 percent of the estimated remaining recoverable oil is expected to come from these same reservoirs.

Mexican Drilling

During 1952, the number of producing wells in Mexico increased 17 percent, the General Statistics Bureau reported, while exploration has been intensified throughout the country, especially in the States of Coahuila and Tamaulipas.

During the period from September, 1951 to June of this year, 243 development wells were drilled, of which 143 were productive. This represents, the bureau commented, an advance of 1,021 percent over previous years. In 1951 total wells completed amounted to 265 and productive wells to 135. By the end of 1952, it is calculated, there will be an increase of 55.5 percent in the former category and 74.5 in the latter.

The bureau's figures covering domestic consumption of petroleum show a steady rise of approximately 8.5 percent annually. Exports this year of crude and products climbed 15.4 percent over their 1915 level.

Canadian Pipe Line Awards

Missouri Valley Canadian Ltd. of Winnipeg has been awarded the contract for three crude oil pipe lines running from Burnaby tank farm to the Shell refinery at Shellburn, Imperial Oil Ltd. plant at Ioco, and Trans Mountain loading dock at Barnet on Burrard Inlet, according to an announcement by Canadian Bechtel Ltd.

The Shell line will be about 2½ miles in length, Imperial six miles, and Trans Mountain three miles. Total cost of the three lines wil run in the neighborhood of $1,000,000. Plans call for construction in the spring.

Opens School to All

Creole Petroleum Corp. has opened a 500-pupil school near its refinery at Amuay Bay which is unique in Venezuela in that it is open to all children, regardless of any connection with Creole. All other company-sponsored schools, including Creole's, are limited to employees' families. The school is part of the growing city of Judibana. Financed two-thirds by Creole and one-third by the Venezuelan government, the city will go through a five-year period of directed planning, after which it is expected to be mature enough to continue growing by itself. It will cost $10 million initially and house 15,000 people within five years, only a small proportion of whom will be on Creole's payroll. Referring to the "hermetically enclosed oil camps" of the past and present, Dr. Edmundo Luongo Cabello, Minister of Mines & Hydrocarbons, said at the inauguration that Venezuela is "looking forward to a new era when oil workers will live in communities made up of all the different human elements necessary to form a well-balanced urban development.

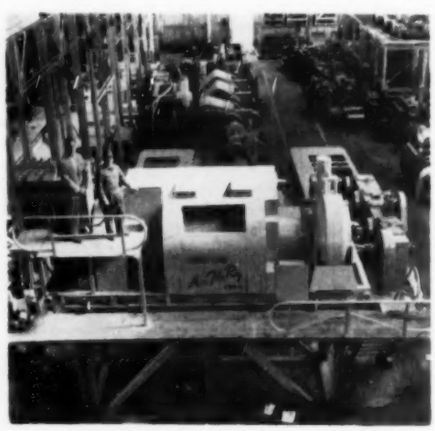
France Buys World's Largest Drilling Rig

IDECO, one of the Dresser Industries, has just completed the manufacture of the largest drilling rig in the world, George W. Walton, vice-president, announced from the oil well equipment firm's Dallas headquarters. Known as Model 1350-S, the giant rig features a console control panel with fingertip air controls that will put over 1,785 hp to work on a drilling operation. The rig will be exported to France for use in oil fields near Pau. It will be used with a 143-foot mast.

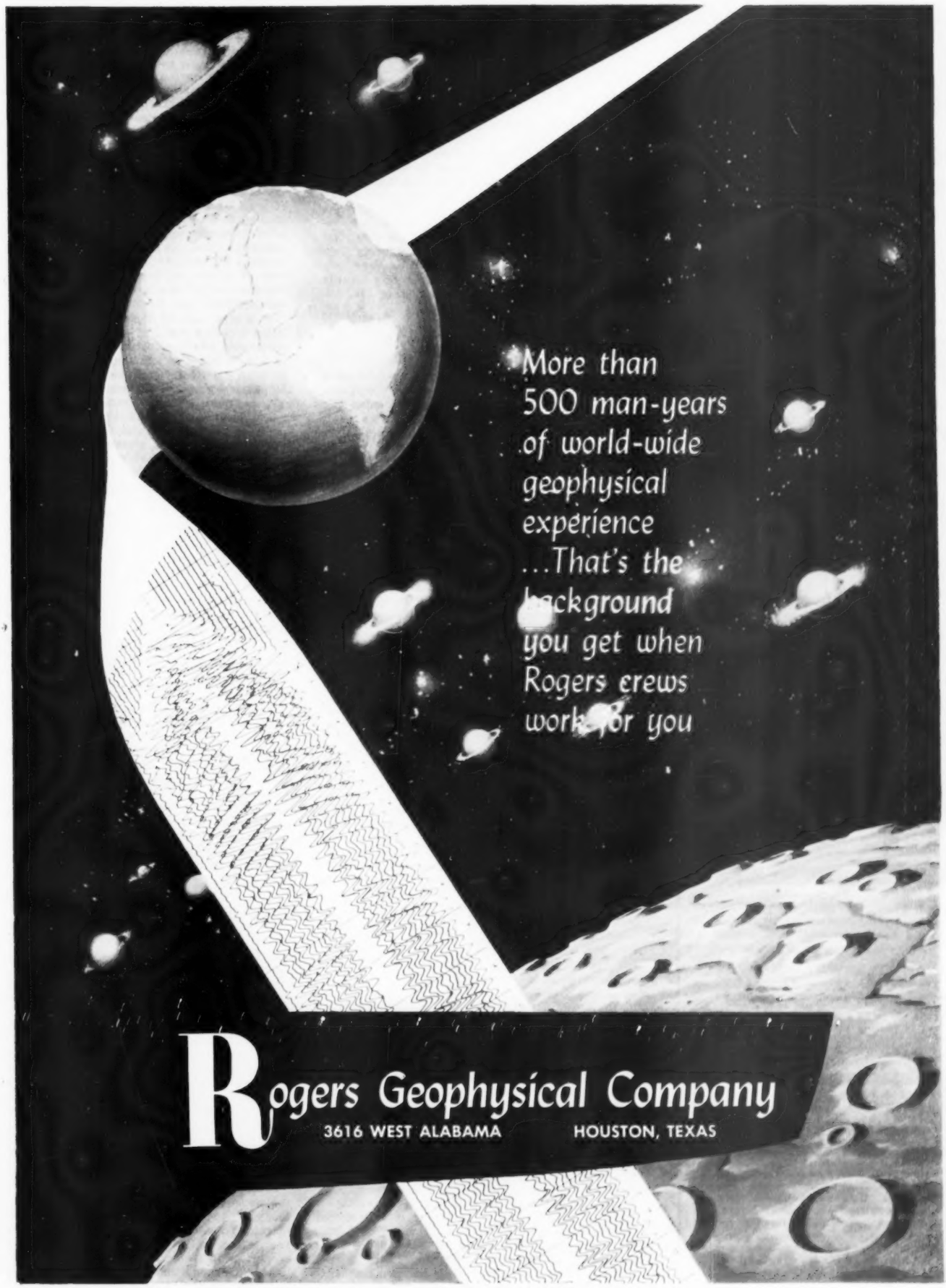
Pierre Gayer, an official of the French government petroleum administration, spent two months in Texas watching completion of the rig. Before returning to France, he made a trip to California where he observed a similar rig in action in the Ventura oil field.

The French government plans to use four SEMT engines having a total of 2,000 output horsepower. These engines are French and powerful enough to make the rig the largest torque-converter-equipped piece of drilling machinery in the world. Cost of the complete rig with engines and pumps will be about $500,000.

The rotary of the rig will be propeller shaft driven. The console control panel will operate the transmission clutches through air controls. Engines will be placed on the derrick floor. The control panel is complete with engine temperature pyrometers, tachometer, engine clutch controls, oil and fuel pressure and rig brake control.



IDECO'S new 1350-S drilling rig.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French Oil Tariff Reduced

By the terms of a revised trade treaty, France will reduce its tariffs on Venezuelan oil and derived products by 25 percent, it was announced in Caracas recently. In return, France will enjoy the same reductions applied by Venezuela to a list of more than 100 commercial products in the reciprocal trade agreement which went into effect between the United States and Venezuela last October.

A Canadian mission of industrialists and businessmen headed by the Right Honorable Clarence Decatur Howe, Canadian Minister of Trade and Commerce, is also in Caracas to discuss trade. Canada has also recently named an Ambassador to Venezuela, the Right Honorable Henry G. Norman. Canada gets 57 percent of its oil from Venezuela, and 10 percent from other sources. In 1951, oil accounted for $125 million of a total of $136 million dollars of Canadian imports from Venezuela, while Canada's export to Venezuela amount to only $27 million. Apparently Canada is seriously concerned about redressing this unfavorable balance.

Maracaibo Dredging

A $15 million contract has been signed between the Venezuelan government and the Compania Fomentadora Occidental, SA, for deepening the Maracaibo bar in the Tablazo Bay area to a depth of 35 feet along a 15-mile stretch, thus permitting tankers and deep-sea vessels of up to 22,000 tons to enter the lake. The work will take 18 months, beginning in March. Construction of at least one seawall two miles long and ten feet above lake level is also contemplated. This is the first phase of a 4-year plan to be financed by the floating of $48 million in bonds, in twelve series. The first five series have been totally subscribed by Shell ($9 million), Creole ($9 million), Mene Grande ($3 million), Texas ($750,000) and Richmond ($600,000). When the dredging job is complete, the company will be repaid by exemption from tanker transit tolls scaled to begin at 10 centimos (3c) per barrel.

Conservation in Venezuela

The conservation of the hydrocarbons of Venezuela is one of the most important objectives of the Ministry of Mines & Hydrocarbons of that country, according to a Ministry publication. By conservation is meant the production and utilization of natural resources in a "prudent, economical, orderly and efficient manner, with a minimum of waste."

The Technical Office of Hydrocarbons studies, investigates and discusses with representatives of the industry the situations and problems observed in the several oilfields so that, with their cooperation, the production of oil and gas may always be effected "in accordance with the most adequate norms of conservation."

The importance Venezuela attaches to its conservation policy was underlined at the Banff meeting of the Inter-State Oil Compact Commission (of which Venezuela is an associate member), where the Venezuelan delegate made public a statement of his country's policy.

Premium Grade Restored In Britain

From February 1 marketing companies in the United Kingdom are permitted to offer premium grades of motor fuel to their customers. It was anticipated that this change would take place in 1952, and some companies installed pumps and other equipment to make this possible, but the government decided to defer action and to confine sales to the single "pool" grade which was set up to meet wartime conditions. Now it is decided that with four catalytic cracking plants in operation and two more coming on stream during the current year, the time is ripe to make the change. Esso has announced that it will offer three grades, Esso extra at a premium of four pence per gallon, Esso Mixture at two pence advance and the standard pool grade at the price hitherto prevailing. It is expected that other sellers will make corresponding increases.

New Concept in Drill Stem Testing

(Continued from page 81)

inating any doubt as to whether or not the tool is open. This indication is shown by a slight jar of the drill pipe and a definite movement of the weight indicator needle.

The Hydrospring Tester has been in constant use since the introduction of the experimental tool in June, 1952. The experimental tool has been run on approximately 150 jobs and is still operating satisfactorily. Other tools have been made and are also giving excellent service in several divisions.

The Hydrospring is run at the top of the testing string immediately below the choke assembly if a choke assembly is run. Since the tester is also a by-pass, the choke must necessarily be run above the tool. The Hydrospring may be lowered in the hole as fast as desired by rig personnel. Several jobs have been noted where the rate of descent was 4 to 4½ seconds per joint. Rotating out of the hole is not affected by using the Hydrospring.

The Hydrospring Tester depends upon a hydraulic cylinder and a spring for its successful operation, hence the name Hydrospring. The tool is composed of four main parts: (1) a spring to keep the tool closed on the surface and to help close the tester when weight is removed; (2) a fluid chamber with a two-way valve mechanism that checks the downward movement of the mandrel and valves, but allows an unrestricted upward movement; (3) a sliding valve composed of "O" rings working inside a cylinder to open and close the tester; and (4) a by-pass valve consisting of a neoprene packing ring and metal seat for its opening and closing. The arrangement of the valve is such that the by-pass closes before the tester valve opens (Fig. 5).

Although this design includes a fluid by-pass and is equipped with tool joints, the length is less than that of tools it has replaced. These features reduce the time required for assembly make-up and offer a more compact unit.

While the Hydrospring Tester is available in only five divisions at this time, the new production schedule from Halliburton's Duncan, Oklahoma, plant will provide each testing operating division with this new product in the near future.

Maracaibo Gas-Injection

Creole Petroleum Corp. has announced a gas-injection installation which will be the largest in Venezuela, returning about 130 million cubic feet daily to producing formations in the Lagunillas-Tia Juana area of the Bolivar Coastal Field. If results are as satisfactory as preliminary calculations suggest, other plants will be built for reservoirs now under study.

The plant, to cost about $17 million, will be built around ten gas turbines of 5,000 hp each, and construction will require 18 months. The compressor plant will stand in the waters of Lake Maracaibo, about six miles from Creole's Tia Juana dock.

Refinery Capacity Increase

Shell plans to raise the capacity of its Punta Cardon refinery to 170,000 barrels per day by about May of 1953. The San Lorenzo plant currently runs about 40,000 b/d, so by mid-1953 Shell will be refining a total of 210,000 b/d in Venezuela, or almost a third of its production. This growth of indigenous capacity may result in diverting some part of the capacity of the giant refinery on Aruba to other purposes, while the refining of Shell's Venezuelan crudes on Curacao will be limited to about 260,000 b/d.

Tanker Fleet

Shell Caribbean had three tankers in Venezuelan service in 1946, totalling 9,610 tons, and today has twelve for a total of 45,858 tons. Two recently transferred from the Dutch to the Venezuelan flag, and two more are scheduled to make the switch in 1953. The change of flag is related to the increasing amounts of crude being refined in Venezuela as compared with Curacao.

Government Sees Need for More Drilling

(Continued from page 73)

tic demand with the exception of aviation gasoline in which a substantial increase is needed. A further important exception is the possible outbreak of full scale war. In this connection, Mr. Hedlund observed that "there has been no moderation of the basic threats to world peace that led to the national defense program." Recognizing that it is impractical to expect the industry to carry enough reserves to permit the fighting of a war with the resources available at its start, he emphasized the importance of the maximum reserve which it is practicable for the industry to carry. An additional factor based on past experience is the necessity of providing in advance for maintenance during a war of a normally high rate of exploration, drilling, refinery construction and related activities.

As a result, when PAD closes shop at midyear and turns over what oil functions it still controls to the Oil and Gas Division, the agency will have some concern about future reserve capacity. This concern is shared by other agencies including the Paley Commission and the National Security Resources Board. They have suggested studies looking toward government buying of proven oil reserves in the ground, but they are staggered by the cost of $10 to $20 billion or more for a reserve able to turn out another half-million barrels of crude daily. Beyond that, there would be heavy maintenance costs.

As a practical matter, therefore, the PAD is ready to settle for something less than its favored goal of 55,000 new oil wells in America this year, while hoping for more than present plans indicate. At the same time it is laying plans to convince government agencies before it goes out of existence of one basic fact. This is that in any possible war, the petroleum industry must receive its normal, peacetime supply of tubular goods to keep up drilling. In other words, the nation must prepare to give the industry two million tons of tubular goods, more or less, to sustain a well drilling program of about 50,000 new wells a year.

In summary, a new world record in oil well drilling is shaping up this year, but the defense agencies want even more wells. In the United States, in particular, they would like to see greater drilling activity, but defense officials are convinced there are limits to what the industry can do under present incentives, and they see little prospect that the government will add new incentives. This leaves a price rise as the most practical incentive, if any is to come.

Broadcast to Japan

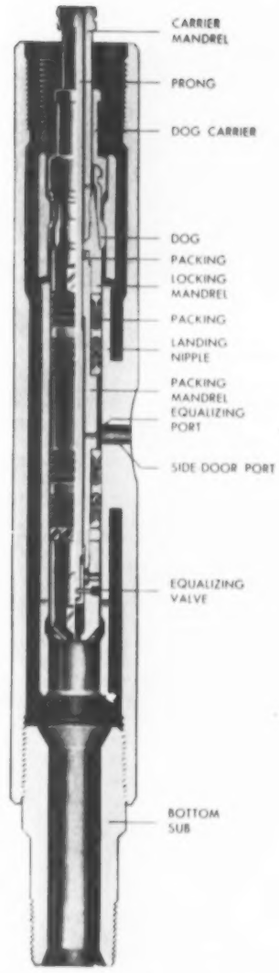
On December 5, 1952, the Voice of America's "America Calling Japan" program of the Far East English service broadcast the comments of Japanese and American oil men on their mutual enterprise. Hank Miller, director of Far East for the Voice of America, interviewed Hiroshi Arai, managing director in charge of the marketing department of the Nippon Oil Company, Ltd., and also director of the Nippon Petroleum Refining Co. and William F. Bramstedt, president of the California Texas Oil Company, Ltd.

Caltex' part in this expansion project for Japanese refineries involves the largest single private industry investment in Japan since World War II.

Swedish Refinery to Double Production

A second distilling unit has recently been placed on stream by the Koppartrans oil refinery at Gothenburg, owned jointly by Stora Kopparbergs Bergslags AB, one of Sweden's leading timber and steel combines, and the Transatlantic Shipping Co. of Gothenburg. Through this extension, the plant will double its production in 1953 to 20,000 b/d and expects to be able to increase production to 24,000 b/d in 1954.

Koppartrans, which will then supply about one-fifth of Sweden's consumption of oil, has so far invested about $16 million in the plant. The crude oil is purchased in the Middle East.



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Type A Otis Side-Door Choke

The Type A Otis Side-Door Choke and Landing Nipple assembly is a new Otis dual-completion tool that provides maximum flow capacity, and is especially suited to formation-fracturing and other similar well completion operations. A new design, consisting of a landing nipple mounted concentrically within an outer flow sleeve, allows the assembly to perform all of the various functions of a conventional Otis Side-Door Choke and Landing Nipple assembly, without restricting the flow to the bore of the choke. The large by-pass area around the seating nipple provides a flow course of more than two square inches for full production through the tubing, or for acidizing, conditioning mud, taking bottom-hole pressures, and various other operations. The new Type A Choke also has a built-in equalizing device to facilitate pulling the tool in the event unbalanced or packed-off pressures prohibit full equalization across the tool. Inasmuch as the seating nipple is independent of the tubing nipple, the same choke can be run in either a 2" or 2½" string.

This new choke assembly is another Otis tool that affords exclusive applications not available in any other production equipment on the market. If you want a better way to get better production from your operations, ask your nearest Otis office, or contact us in Dallas, for full details on this and other Otis single- and two-zone production equipment. There's no obligation, of course.

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Mid-Continent Supply Promotions

Recent appointments and promotions announced by Mid-Continent Supply Company include the naming of T. M. Cone as chief engineer and manager of the engineering department at Fort Worth. W. D. Poteet has been made assistant chief engineer and J. M. Harris becomes special sales engineer in the machinery department.

Revised Tax Manual

A revised edition of a manual explaining the Bureau of Internal Revenue's regulations governing federal taxes on gasoline and lubricating oil has been issued by the American Petroleum Industries Committee. The 80-page paper-bound book is entitled "Manual of Interpretations of Federal Regulations 44, Revised," and is written in non-technical language to assist oil company tax men in complying with procedures relating to these excise taxes.

Copies of the manual may be obtained by writing the American Petroleum Industries Committee, Room 2040, 50 West 50th Street, New York.

Desk and Derrick Elects

The Desk and Derrick Club of New York elected new officers and directors at a meeting on December 11. The Texas Company was host at a Christmas party following the business meeting and election of officers.

Officers elected to serve during 1953 are: president, Edna Hurry, Standard Oil Company (N. J.); vice president, Elizabeth Van Kuyk, Socony-Vacuum Oil Company; recording secretary, Ida Tangemann, Standard Vacuum; corresponding secretary, Frances Gasper, Oil Industry Information Committee; assistant corresponding secretary, Constance Keller, Esso Standard; treasurer, Laura Chebbits, The Texas Company; assistant treasurer, Clara Jones, Shell Chemical Co.

Directors elected for one year are: Evelyn Darby, Socony-Vacuum; Mae Masters, Cities Service Oil Company; and Marceline Marquis, Ethyl Corporation. Directors elected for two years are: Gertrude King, Gulf Oil; Margaret Sweeney, Sinclair Oil; and Ruth Kellner, Continental Supply.

Basic Raw Material from Petroleum

Piccopale, a new, low cost, basic petroleum raw material, has been developed by Pennsylvania Industrial Chemical Corp. Available in quantity, this synthetic resin is essentially a hard hydrocarbon produced by the polymerization of unsaturates derived from deep cracking of petroleum.

The 100 percent polymerized petroleum resin is available in three forms: solid, flaked and in solution. It is a clear, transparent thermo-plastic. According to the manufacturer, it has good chemical resistance, ready solubility and compatibility with a wide range of products. The nature of piccopale allows the manufacture, in volume and at low cost, of a material to fill the gap between petrolatum and petroleum rubbers in the following series: petroleum solvents, oils, waxes, petrolatums, piccopale and petroleum based elastomers and rubbers.

The manufacturer states that piccopale has cost-saving and product-improving characteristics which make it a useful raw material for many different industries, among them being chemical, textile and floor covering, pulp and paper, lumber and wood products, petroleum, rubber, leather, plastic, stone, clay and glass, metal and metal working, electrical equipment and others.

Magcobar Promotions

Frank Ford, Jr. has been promoted to district supervisor of the Houma, La. district of Magnet Cove Barium Corp. to succeed R. E. Hinchliffe who was transferred to the Lake Charles district as supervisor. Before joining Magcobar, Mr. Ford worked as a rotary helper with Shell Oil Co., Bankhead Drilling Co., Sugarfield Oil Co. and Loffland Bros. Drilling Co.

Promotion of Earl N. McArthur, Jr. to district service supervisor in the Victoria area for Magnet Cove Barium Corp. has been announced by Ray Dillman, Magcobar Gulf Coast Division manager. Previous to his appointment, he was a field service engineer in the Victoria area.

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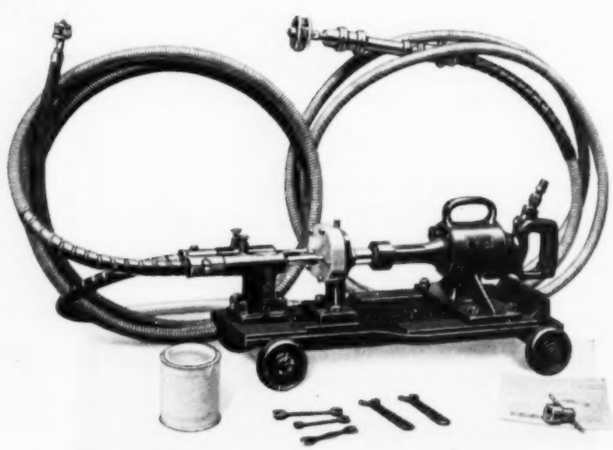

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North Dakota Refinery

Standard Oil Co. (Ind.) has selected the Lummus Company of New York City as prime contractor for construction of its new 30,000-barrel refinery at Mandan, N. D. Construction is expected to start in the late spring with completion scheduled for October, 1954.

For the first time in Standard's history crude running, fluid catalytic cracking, vapor recovery, and polymerization will be combined into a continuous manufacturing process in an integrated unit.

The new Mandan refinery will be Standard's sixth in the 15 midwestern states in which the company markets. Service Pipe Line Co. will build a crude oil pipe line to the new Mandan refinery. Products will be shipped by rail, truck, and by a products pipe line to Moorhead, Minn. At Moorhead a connection will be made with Standard's present northern products pipe line which originates at Whiting, Ind.

New Ammonia Plant

Brea Chemicals, Inc., will lease and operate a specially designed $13 million ammonia plant to be built at Brea, Calif. The chemical firm, a newly organized subsidiary of Union Oil Co., will manufacture the ammonia from natural gas taken from wells near Brea, 30 miles east of Los Angeles. C. F. Braun & Co. will design and build the plant. Completion is scheduled for the summer of 1954.

Heads Ethyl Fuel Technology

Jack D. Fuller has been appointed manager of fuel technology for Ethyl Corp. He is to be assisted by C. Alon Cole, eastern region, at New York; Fred P. Robinson, central region, at Chicago; and Martin L. Alspaugh, southern region, at Tulsa. Herbert N. Peters continues as western region fuel technologist with headquarters at Los Angeles.

McIntire Heads New York Nomads

Russ V. McIntire, Baker Oil Tools, Inc., will head activities of the New York Chapter of Nomads as president during 1953. Other new officers elected at a business meeting January 5, 1953 at the Stork Club are: vice president, C. J. Delay, the Continental Supply Co., Inc.; secretary, O. B. Latrobe, Hughes Tool Co.; assistant secretary, G. I. Lynch, Lee C. Moore Corp.; treasurer, N. L. Boulden, Jr., International General Electric Co., Inc.; assistant treasurer, L. F. Griffith, Petroleum Machinery Corp.; sergeant-at-arms, Edmund Burke, Jr., General Motors Overseas; assistant sergeant-at-arms, H. W. Haltom, Beckly, Haltom and Hickman; regent, H. B. Book, Reed Roller Bit Co.; and regent, A. A. Dill, Axelson Manufacturing Co.

New York Chapter of Nomads officers for 1953 are, left to right: A. A. Dill, G. I. Lynch, Edmund Burke, Jr., C. J. DeLay, R. V. McIntire, O. B. Latrobe, N. L. Boulden, Jr., and L. F. Griffith.

New LPGas Terminal

An LPGas storage terminal will be built at Hutchinson, Kans. by Cities Service Oil Co. It will include underground storage capacity of approximately 4 million gallons, some aboveground storage, and rail and truck loading and unloading facilities. The underground storage will be washed out of the salt formation underlying the acreage just leased by Cities Service.

Petreco Expands Research Facilities

Petreco Division of the Petrolite Corporation has completed an addition to research facilities at its Webster Groves, Missouri, laboratories. Included are facilities for the investigation of electric fields and for study of the chemical phases of the various electric treating processes developed by Petreco, as well as an extensive pilot laboratory in which the various applications of electric processing are studied and developed in small-scale equipment. Supplementary facilities such as photographic equipment and dark room, fireproof storage for hazardous liquids, maintenance shops, storerooms and office space also have been provided.

The electric petroleum refining processes now being studied by the Petreco research and development staff include acid and alkali treating of lubricating and lighter distillate fractions, removal of salts and other impurities from crude oils, dehydrating of emulsified crude oils, sweetening of distillates, and improvement of stocks charged to catalytic cracking units. In addition to these studies, a continuing development program is under way toward the improvement of electric treating equipment and methods.

Diesel Fuel Additive

Commercial availability of a new ignition improver for diesel fuels, following a year-long test program with the U. S. Navy, has been announced by Ethyl Corp. Called Ignition Improver (DB-36), the new additive consists of a mixture of primary amyl nitrates.

Shipments of Ethyl's Ignition Improver will be made in tank car and 55-gallon drum quantities, with distribution to be handled from both the east and west coasts. Blending the additive into diesel fuel, according to Ethyl's announcement, is a simple and inexpensive operation that can be performed either at a refinery or a storage terminal. Ethyl's Ignition Improver is said to blend quite readily with diesel fuel, and no unusual safety precautions are required.

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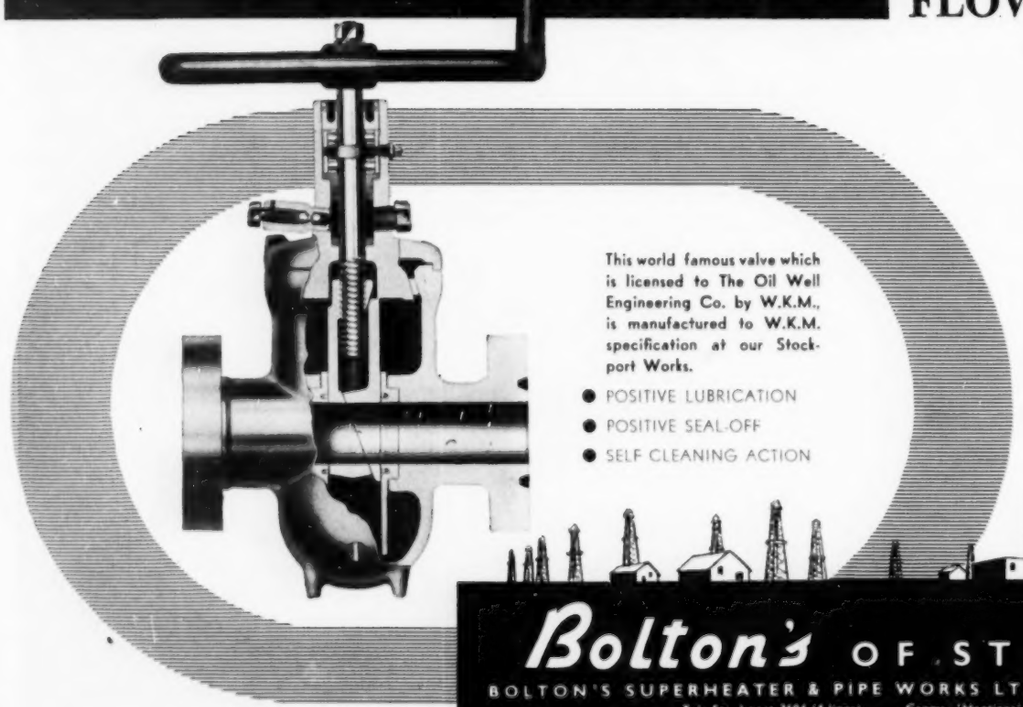

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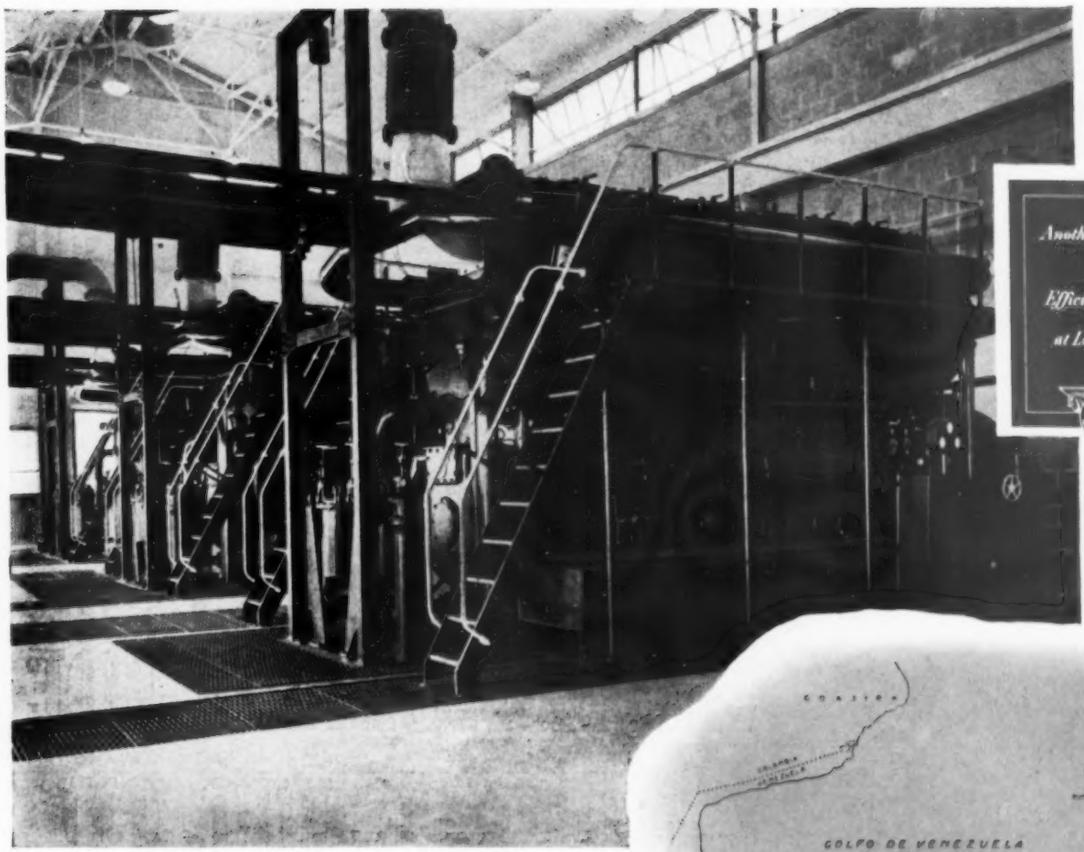

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THE three LSV-12 Gas-Diesels shown here, installed at Palmarajo de Mara, power the new 30", 165-mile line operated by Shell Caribbean Petroleum Company. Not only is this a remarkably quiet, "sweet running" station with an extreme minimum of vibration, but its operators consider it the ultimate in flexibility.

For example, the engines have automatic speed control, with provision for manual control from the main switchboard or from the panel at each engine. The automatic control is governed by the discharge pressure of the station (pumps in series), thus automatically balancing the load between the units. Pipe line safety is further assured by high pressure, high-flow engine shutdown devices.

On the whole, here's more evidence that for pipe line pumping . . . for *any* stationary service . . . modern Cooper-Bessemers are your best bet.

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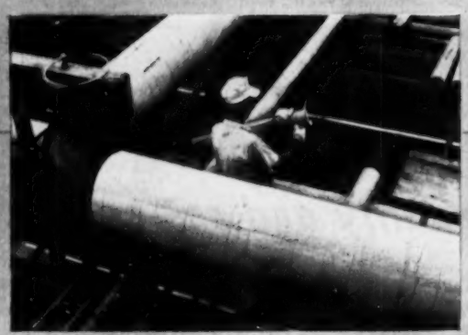
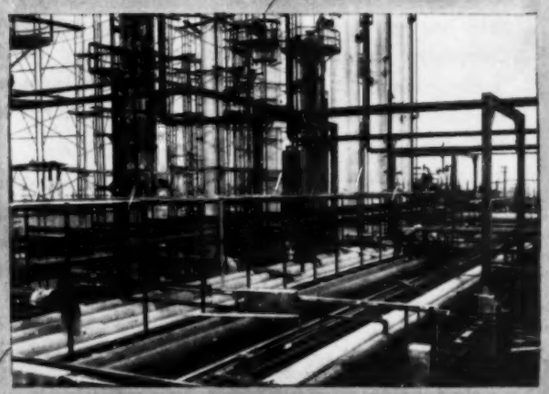
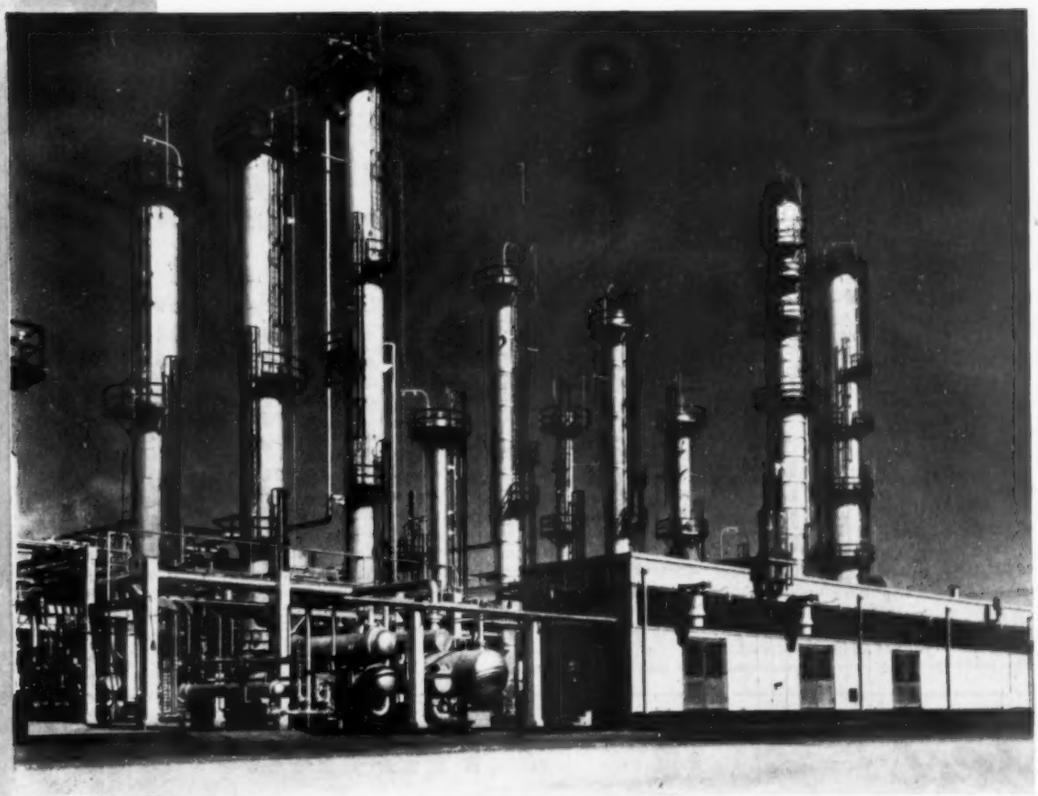
Cosden is first
to produce
all three aromatics
plus Platformate

with PLATFORMING-UDEX
facilities . . . built by PROCON







Completed by Procon in 11 months, the Platforming-Udex installation at the Big Spring, Texas, refinery of Cosden Petroleum Corporation is the **first** to produce all three aromatics — benzene, toluene, and xylene — plus a high octane motor fuel blending component.

Handling a charge of approximately 4500 barrels per day, the new facilities include a feed preparation section, a UOP Platforming Unit, a Udex unit, and a super-fractionation section. In addition, Procon also built accessory processing equipment, roadways, buildings, and utilities. All work was handled with maximum dispatch, and labor costs for the completed job were considerably below pre-construction estimates.

The successful and economical completion of this new plant is typical of Procon service on large and small construction projects for petroleum refiners throughout the world.

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M. C. Pollock

Forms Foreign Trade Subsidiaries

Cooper-Bessemer Corp. has formed two wholly-owned subsidiary companies to be known as Cooper-Bessemer International Corp. and Cooper-Bessemer Overseas Corp. The new companies serve as exclusive export sales distributors for Cooper-Bessemer engines and compressors. Cooper-Bessemer International will handle all sales of the company's products in the Western Hemisphere outside the United States. Cooper-Bessemer Overseas will be responsible for sales to the rest of the world.

Both companies are headed by Michael C. Pollock, with a staff of assistants, located at 25 West 43rd Street, New York. Present plans provide for Cooper-Bessemer International offices in Caracas, Sao Paulo, and Mexico City.

Named Contractor for Casper Refinery

Standard Oil Company has selected the M. W. Kellogg Co. of New York City as prime contractor for the construction of a new 700-barrel alkylation unit at its Casper, Wyo., refinery, it was announced recently by Dr. C. C. Buchler, manager. Construction is expected to begin during the summer of 1953. Completion and initial operation are scheduled for May, 1954. Other additional new construction will provide tankage and off-site facilities necessary to integrate the new alkylation unit with the existing refinery at Casper.

Refinery Inspection Tool

A new fifty-foot cable is now available for the Sonoflux magnetic inspection instrument. This long cable greatly simplifies the problem of inspecting flanges, tubing, vessel plate and welds, furnace castings, cooling tower fan hubs, and towers in place in refineries and chemical plants. The Sonoflux unit remains on the ground, while the operator need carry only the Sono-Probe to make inspection. The Sonoflux operator on ladder or cat walk, equipped with this cable and Sono-Probe, can do the same quality inspection as was formerly done by hoisting an entire inspection unit on a crane.

Hughes Tool Promotions

Dr. Daniel J. Martin, vice president of engineering, Hughes Tool Co., has announced the promotion of Lyle L. Payne to assistant vice president, engineering. R. S. Grant has been appointed chief product engineer in charge of the product engineering department to succeed Mr. Payne, and A. P. Farr has been appointed assistant chief product engineer.

R. F. Herr

Harnischfeger Adds Export Companies

Harnischfeger Corp., Milwaukee, has announced the formation of two subsidiary companies to handle its expanding business outside the United States. They are the Harnischfeger Export Corp., which will be in charge of the sale and distribution of P&H products in other countries of the Western Hemisphere, and the Harnischfeger Overseas Corp., which will handle P&H activities in the remainder of the world. Harnischfeger's policy of product distribution through local outlets will be continued by the subsidiaries.

Officers named are: Henry Harnischfeger, appointed chairman of the board for the new companies; R. F. Herr, president; W. P. Hoban, vice president; and A. W. Pipenhagen, secretary and treasurer.

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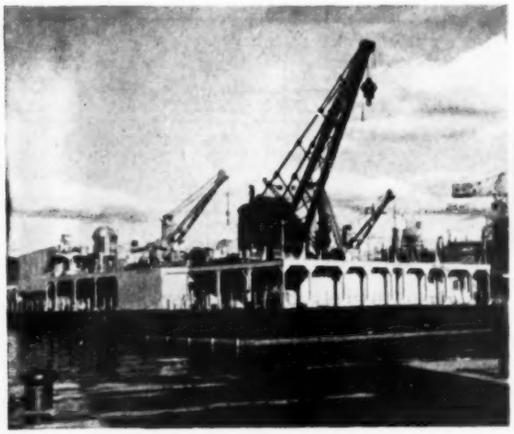

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M. A. Ellsworth *L. R. Lyon*

Fluor Corporation Promotions

M. A. Ellsworth, formerly vice president of the Mid-Continent area for The Fluor Corporation, Ltd., has been appointed vice president and director of sales. He has transferred to Fluor's main office and plant, Los Angeles. Mr. Ellsworth has been with Fluor for the past 11 years. Before that time he was with the H. H. Roths Co. and the Whelling Steel Co. L. R. Lyon, formerly district engineer for Fluor's Tulsa district sales office, has been appointed district sales manager of the Tulsa office.

A. W. Ambrose

Arthur W. Ambrose, chairman of Cities Service Oil Co. and his wife, the former Alma Locke, were killed in an automobile accident near Tulsa, Okla. December 28, 1952.

Mr. Ambrose began his career in petroleum in 1914 as a geologist for Shell Oil Co. in the Coalinga field in California. He joined Cities Service Oil Co. in 1923 as manager of its land and geological division. In 1930 he was promoted to vice president and assistant general manager, and in 1946 he was elected president. In January, 1952, Mr. Ambrose became chairman of Cities Service Oil Co., Delaware, with headquarters in Bartlesville, Okla. He was a director of Cities Service Co. and Richfield Oil Corp.

Grease Applicator

A new method of applying lubricant to tool joints, drill collars, drill tubing and casing has been developed by Jet-Lube, Inc. of Los Angeles. The equipment, known as the Jet-Lube Applicator, consists of a flexible head, swivel-mounted to a handle, and a trigger-operated control valve connected to a high-pressure hose carrying lubricant under pressure from an enclosed container and pump. The head is inserted into the box of the joint and the grease, in an enclosed system, is forced into the threads from the bottom to the top, forcing out drilling fluids and contamination. Brushing is eliminated and the container is off the rig floor.

New Aid for Making Up Tools

Dresser Equipment Company, IDECO Division, has been appointed exclusive jobber for the Craigo Joint Rotor manufactured by the Craigo Supply Co. at Long Beach, Calif. With the Craigo Joint Rotor one man can stab bits and subs in half the time ordinarily required for making up tools. It reduces wear on the starting threads and shoulders.

Catalytic Appoints Gerner

T. Ellwood Webster, president of the Catalytic Construction Company, announces that Charles R. Gerner has been appointed director of purchases to succeed Logan Campbell, retired. Mr. Gerner was appointed assistant director of purchases in 1946 following a tour of duty in the United States Navy as a Lieutenant.

Security Sales Appointment

Cecil C. Scott has been appointed central mid-continent regional sales manager for Security Engineering Co. He will have charge of all Security sales in Texas west of Abilene, as well as in the New Mexico, Colorado, Wyoming, and North Dakota territories.

Howard J. Nebeck

Howard J. Nebeck of Universal Oil Products Co. died of a heart attack at his home in Berwyn, Illinois, January 27, 1953. As coordinator of engineering, he was well known in the petroleum industry for his work in the development and design of commercial alkylation units during the war and, more recently, his contribution to the development and design of commercial UOP Platforming units.

Orbit Valve Announces Appointments

Two new regional sales manager appointments announced by R. G. Cole, general sales manager of Orbit Valve Co., are those of H. C. Sawyer and L. E. Wallace. Mr. Sawyer, who has been mid-continent district manager in Tulsa since October 1949, is being transferred to Midland, Texas, as regional sales manager and will have under his supervision a division consisting of North Texas, West Texas, New Mexico and an area extending into the Rocky Mountains. Mr. Wallace will now have under his supervision an area consisting of the Gulf Coast and Southwest Texas as well as East Texas, Louisiana and Mississippi.

H. C. Sawyer *L. E. Wallace*

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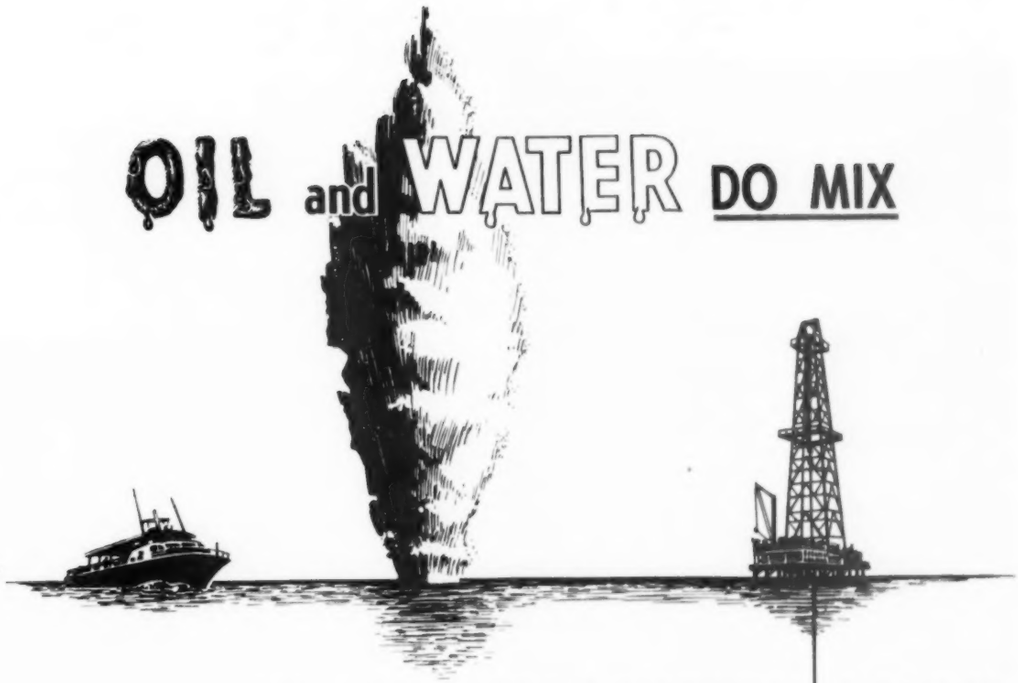

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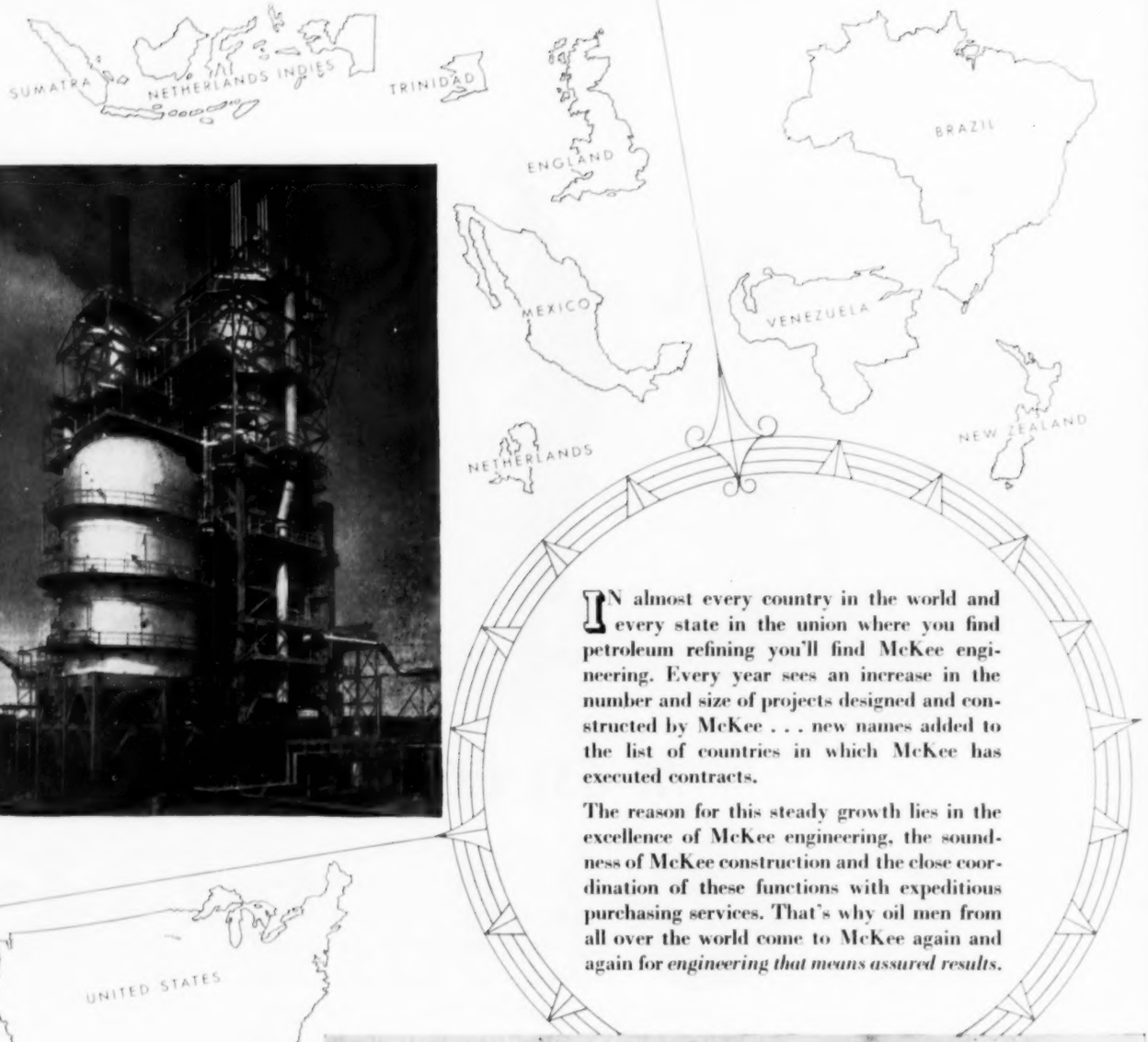
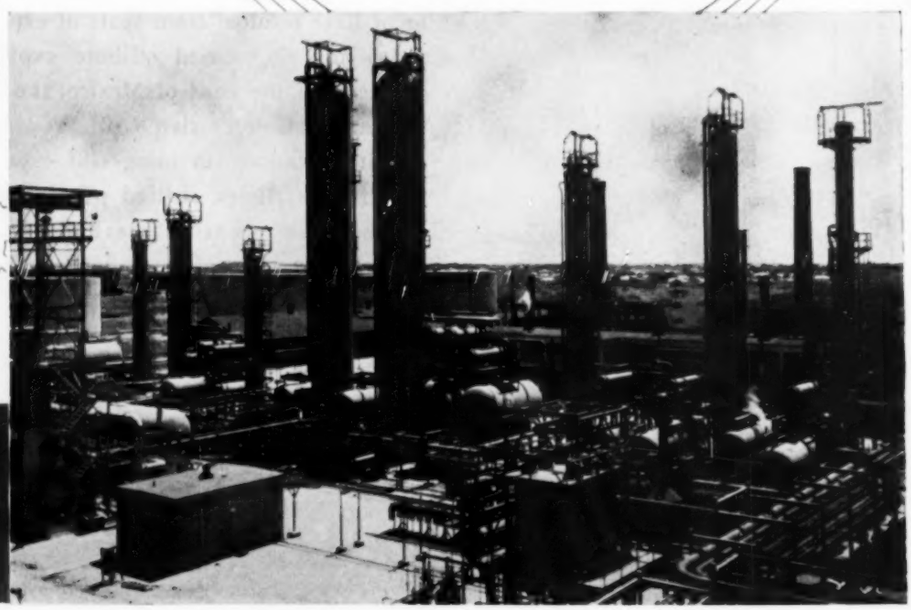
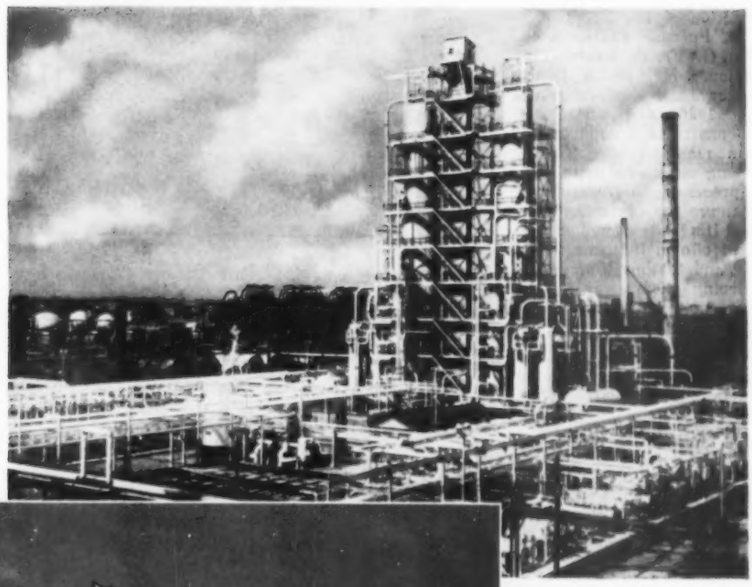
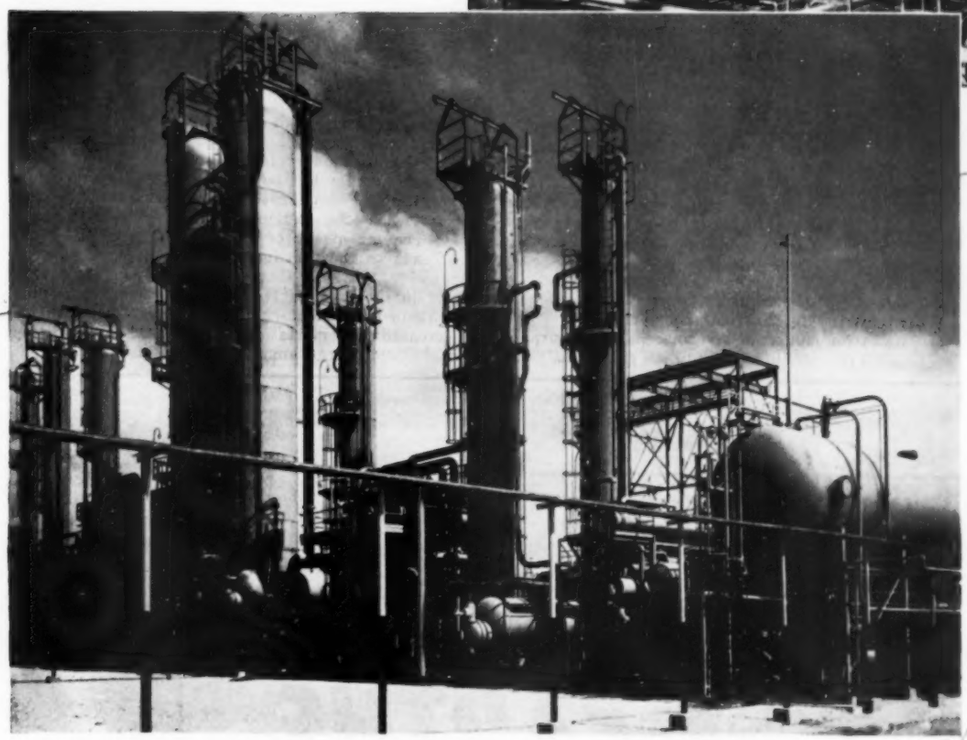


IN almost every country in the world and every state in the union where you find petroleum refining you'll find McKee engineering. Every year sees an increase in the number and size of projects designed and constructed by McKee . . . new names added to the list of countries in which McKee has executed contracts.

The reason for this steady growth lies in the excellence of McKee engineering, the soundness of McKee construction and the close coordination of these functions with expeditious purchasing services. That's why oil men from all over the world come to McKee again and again for *engineering that means assured results.*







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M. W. Kellogg Appointments

The appointment of Joseph W. Smith as general manager of construction of The M. W. Kellogg Co., a subsidiary of Pullman Incorporated, has been announced by G. Frank Bayes, vice president for construction. Mr. Smith joined Kellogg, petroleum refinery and chemical plant engineer-contractors, in 1936, and since that time has been in the construction department, most recently as assistant manager.

Henry P. Wickham, long associated with Kellogg's fluid catalytic processing developments, has been selected to manage the operating division of the company. His duties will be to broaden technical service efforts in three fields. These include operating and testing Kellogg-designed units before turning them over to the customer and instructing customer technicians.

Heads Valve Sales

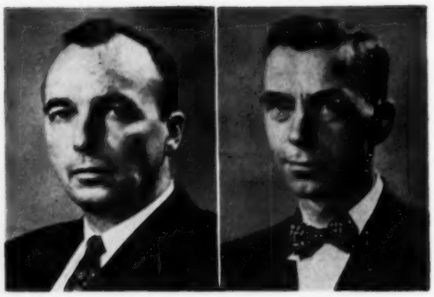
James R. McCutcheon, Jr., has been appointed sales manager of the valve division of Homestead Valve Manufacturing Co., Coroapolis, Pa. For the past seven years he has served as district representative for American Car and Foundry Company's valve division in Western Pennsylvania, Ohio, Kentucky, and West Virginia.

Okie Elected Houdry Director

John B. Okie, vice president and director of World Commerce Corp., has been named a director of Houdry Process Corp. During World War II, Mr. Okie was attached to the American Embassy in Portugal and Spain. In addition, he spent some 12 years in South America and Europe employed by various firms.

To Build Catformer

The Atlantic Refining Co. has announced the addition of The United Refining Co., Warren, Pa., to its list of Catformer licensees. United is building a 2,500-barrel Catformer for its Warren refineries with the Blaw-Knox Construction Co. of Tulsa, Okla., acting as designer and contractor.



J. W. Smith *H. P. Wickham*

LP-Gas Sales Rise

Sales of LP-Gas rose 6.7 percent in 1952 to 4,110,000,000 gallons exclusive of the 400 million gallons used for the manufacture of synthetic rubber components, according to estimates prepared by George R. Benz, manager of the engineering department of Phillips Petroleum Co. and P. W. Tucker of the same company.

Weather in most areas again played a vital role in the domestic and motor fuel sales of LP-Gas. The country, with the exception of the upper midwest states, experienced a very mild year with above-normal temperatures prevailing during the late winter of 1951 and the early winter season of 1952. This was responsible to a large extent for the less than normal rate of increase, estimated at 9.2 percent.

Consumption of LP-Gas as motor fuel in 1952 rose an estimated 25 percent over the 1951 volume. Increased consumption by trucks, buses and farm tractors, many of which were converted to LP-Gas usage during 1951, accounted for a major portion of this increase. The severe drought in the Southwest resulted in greatly increased use of irrigation pumps, many of which are powered by LP-Gas fueled engines.

Sales for industrial and miscellaneous purposes totalled an estimated 275 million gallons at year's end, an increase of 2.1 percent over 1951. There were two major factors which affected industrial sales. These were the steel strike and the extension and expansion of natural gas lines.

Gas manufacturing consumed 266 million gallons of LP-Gas, a decrease of about 5.7 percent compared to the preceding year. There are three main factors contributing to this decrease. These include: (1) mild weather, (2) extension and expansion of natural gas lines, and (3) the steel strike. As 1952 closed, there were several hundred towns served by about 366 city gas companies using LP-Gas as base material in gas manufacture, peak shaving, enriching, or for standby in 39 states and 3 provinces of Canada.

The use of LP-Gases as raw material for the manufacture of chemicals and chemical intermediates still continues strong. An estimated 886 million gallons were sold for this use, representing a 4.9 percent increase over last year.

The use of LP-Gases as raw material for the manufacture of synthetic rubber components increased an estimated 6.7 percent to a total of 400 million gallons for the year.

Underground storage of liquefied petroleum gas in caverns washed out of salt beds or salt domes or in caverns mined out of suitable formations is increasing. Present underground storage capacity for LP-Gas is nearing 3 million barrels. Over twice this amount of such storage is under construction or under active consideration. This type of storage, however, is not the answer to the industry's problem of seasonal demand vs. year-round production. LP-Gas storage is a problem of all phases of the industry. There must be a balance of storage between the producer, bulk-distributor and customer. The development of a good summer load and the maintenance of a low winter to summer ratio still demands the full attention of industry.

The movement of propane by pipe line from Texas to the Chicago area was begun this year and a third LP-Gas barge was put in service.

Recently completed production facilities plus plants now under construction together with increased transportation facilities should provide additional large amounts of LP-Gas in 1953.

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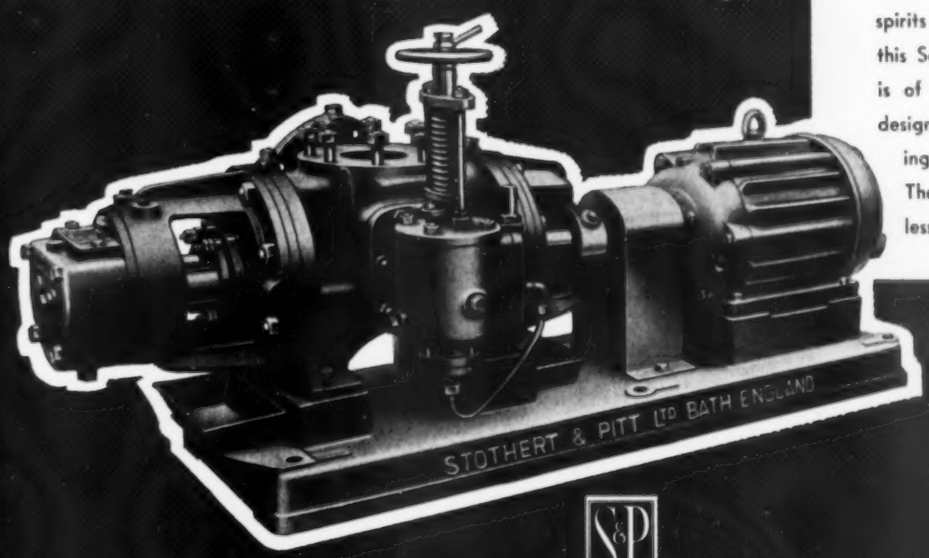
Aviation Spirit Pump



Eminently suitable for handling spirits and other volatile fluids, this Screw Displacement Pump is of the all round clearance design and is capable of working with a high suction lift. The flow is practically pulseless and the unit self priming.

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Union Challenges Pemex

The entire legal structure under which foreign oil and service companies are carrying on activities in Mexico has been challenged by Local 34 of the Mexican Oil Workers Union, which has asked the Federal Attorney General's office to take action to cancel the concessions. The union described the percentage-of-production contracts under which most of the oil and drilling companies operate as a "menace to expropriation."

Specific companies whose contracts were cited by the union as falling within this category are: E. W. Pawley, Mexican-American Independent Oil Co. (Cima), Kermac Contractors, the Signal Oil Co., Sharmex Co., Halliburton Oil Well Cementing Co., Hycalog Co., Latin American Exploration Co., Wiegand Brothers, Rotary Engineering Co., Geophysical Service Co., Schlumberger Corp., Perforaciones, S.A., Perforaciones Economicas, S.A., Tre-O-Lite Co., Seismograph Service, American Exploration Co., Isthmus Development Co., Petroleos y Derivados, Perforadora del Golfo and Rotenka, S.A.

German Refineries Enlarge Runs

Refineries of Western Germany processed 5,154,480 tons of crude oil and 185,347 tons of semi-finished products during 1952 to yield a total of 5,139,212 tons of finished products. Total throughput was 12.7 percent greater than in 1951. Domestic crude supplied 32.4 percent of the runs as compared with 28.7 percent in 1951.

Gas for Italian Chemical Plant

First chemical plant in Italy to utilize natural gas was opened in December at Novara by the Montecatini Co. The plant will produce 45,000 metric tons yearly of ammonium nitrate, 35,000 of ammonium sulfate and minor quantities of urea and other nitrogen compounds.

C. A. P. Southwell

C.A.P. Southwell, managing director of Kuwait Oil Company Ltd., was made a Commander of the British Empire (CBE) in the Queen's latest Honors List. Investiture of the recipients of titles and awards was made at Buckingham Palace last month.

Date Set for World Congress

Meeting at Rapallo, Italy, on January 21, the Permanent Council of the World Petroleum Congress discussed plans for the Fourth Congress which will meet in Venice during the first week of June, 1955. Members of the Council, which is headed by Dr. E. V. Murphree, president of Standard Oil Development Co., conferred with the Italian organization committee, composed of Italian oil company executives and officials of the national government, on matters relating to the general program, financial plans and technical subjects to be included in the program.

Italian Petroleum Trade in 1952

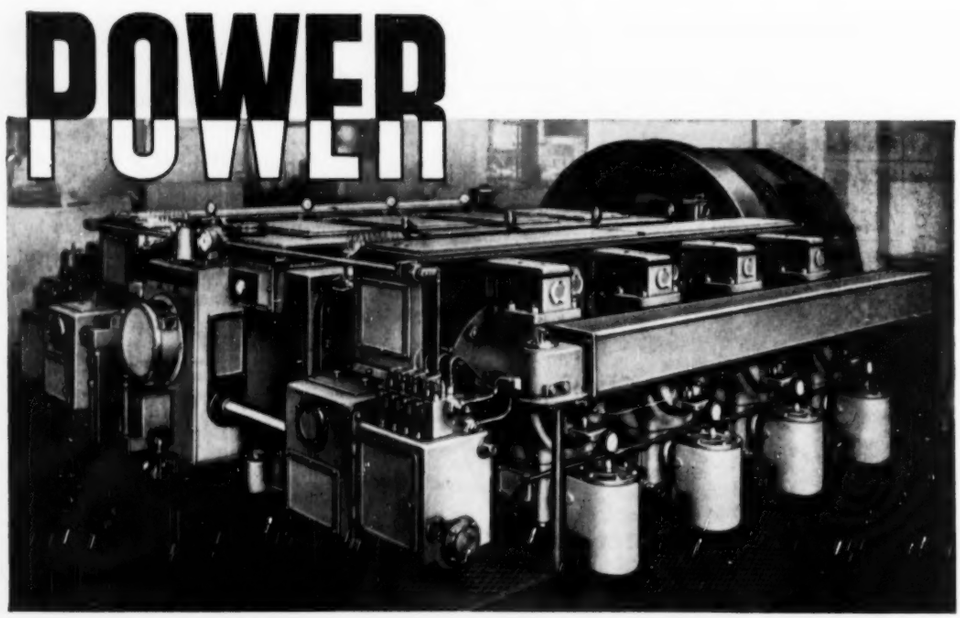
Import and export of crude oil and finished products in Italy during 1952 are reported in the following table, as compared with 1951.

	1951	1952 Approximate	% Difference
IMPORT (Metric Tons)			
Crude Oil	7,334,000	8,850,000	+ 20.67
Gasoline	35,000	16,000	— 54.70
Kerosine	182	.....	—100.00
Gasoil and Diesel Oil	21,300	4,200	— 80.30
Fuel Oils	675,000	280,000	— 58.50
Lube Oils	73,000	38,000	— 48.00
Total	8,139,182	9,188,200	
EXPORT (Metric Tons)			
Gasoline	437,000	650,000	+ 48.46
Kerosine	176,000	330,000	+ 87.50
Gasoil and Diesel Oil	376,000	540,000	+ 43.62
Fuel Oils	372,000	980,000	+163.45
Total	1,361,000	2,500,000	

Import of crude from Saudi Arabia in 1952 was 4.6 million metric tons (66 percent increase over 1951), while import from Iraq followed with 1.9 million (270 percent increase over 1951). Imports from other Middle East countries reached two million tons. The Middle East as a whole supplied 93 percent of Italian crude imports, though there was no import from Iran.

The decrease in import of finished products is balanced by the increased import of crude.

Italian consumption of petroleum products in 1952 is estimated at 5,660,000 tons, an increase of roundly nine percent over 1951. Products most in demand were fuel oils, including gas oil and diesel oil, which accounted for 80 percent of the total.



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THE hole is already there when you use Timken® seamless tubing. Often, you can go right into finish boring as your first production step. You save machining time. Screw machine stations can be released for other operations. You get added machine capacity without additional machines.

By using Timken seamless tubing in place of bar stock, you save steel, too. Scrap loss is cut. You get more parts per ton of steel. And to help you save even *more* steel, the Timken Company offers a tube engineering service which recommends the most economical tube size for your job—guaranteed to clean up to your finished dimensions.

Timken seamless tubing gives you high internal quality because the piercing process by which it is made is basically a forging operation. Result: a uniform spiral grain flow for greater strength and a refined grain structure which brings out the best quality of the metal. And the Timken Company's rigid control keeps this quality uniform from tube to tube and heat to heat. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

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J. S. Broom

Service Engineer Appointed

J. Sidney Broom has been appointed fishing tool service engineer at the McCullough Tool Company's Vernal, Utah branch, according to an announcement by I. J. McCullough, president. Mr. Broom, an expert fishing tool operator, has had over 26 years of experience as a driller, toolpusher, and superintendent with leading oil companies and drilling contractors in the Rocky Mountain, Mid-Continent, and California oil fields.

Logan Campbell Retires

Logan Campbell, director of purchases of Catalytic Construction Co. since 1946, has retired. Prior to his association with Catalytic Mr. Campbell had been purchasing agent for Sun Oil Co. In addition, Mr. Campbell had served with Sun Shipbuilding and Drydock Co. His total service with these companies is almost thirty years.

Report Progress on Vibration Belt

Because of the satisfactory progress made during the past year, Drilling Research, Inc., cooperative research corporation, plans to continue its investigations in 1954. When first organized in 1949, the 40 company stockholders underwrote a primary five-year program for which they pledged payments totaling $1,178,976.

In the 1949-52 period the research cost $854,355 and $324,620 remains for the 1953 program.

Fundamental studies of "how rock fails" have been conducted under company sponsorship at Columbia University, New York, while Battelle Memorial Institute, Columbus, Ohio has been working on the development of equipment for vibration drilling. The method being studied involves electro-magnetic methods of activating a high frequency chisel as a drilling bit. The bit will be a percussion type resembling the old-time cable tool but without many of its disadvantages.

The technical committee and staff of the research project have concluded that their work has progressed to the point where the feasibility of vibration drilling can be definitely determined soon. Within the past year Battelle researchers have operated vibration drills in limestone quarries near Columbus. Next step will be to build an 8¾-inch bit for full-scale drilling in deep holes.

Phillips to Explore In Alaska

Under a development contract with the federal government, Phillips Petroleum Company has undertaken to drill 12 exploratory wells over a period of ten years on a tract of nearly a million acres in the Katalla-Yakataba area in Alaska.

Under the terms of the agreement, the company will spend a minimum of $1,200,000 on exploration prior to June 30, 1956 and thereafter a sum equal to 40 cents an acre as a minimum. Two wells must be drilled by mid-year 1956 and two more must be started within the following 12 months. For each of the succeeding four years an exploratory well must be drilled in each of the two districts.

J. F. Alexander

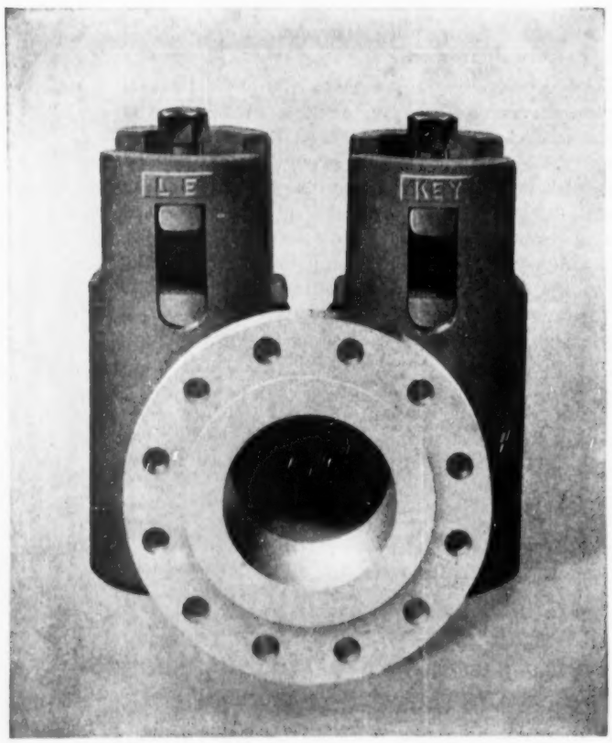
Alexander Returns to Lane-Wells

James F. Alexander, formerly Los Angeles district superintendent for Lane-Wells, has returned to the company after a 16-month tour of duty with the Army. He is now assistant to the Mid-Continent division operating superintendent.

Heads Sun Ship Sales

J. H. G. McConechy has been appointed assistant to the president, new ship sales, of Sun Shipbuilding & Dry Dock Co., Chester, Pa. The move contemplates the utilization of Mr. McConechy's technical engineering knowledge in discussing contracts with customers. David Mylrea became chief engineer of Sun Ship effective January 1. He was formerly chief draftsman of the engineering department, and now replaces Mr. McConechy. Earl Broomall assumed Mr. Mylrea's former position, chief draftsman, engine drawing department, on January 16.

FOR OIL REFINERY & CHEMICAL PLANTS



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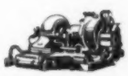
For Driving Pumps etc.



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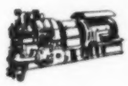

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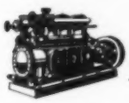

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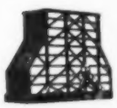

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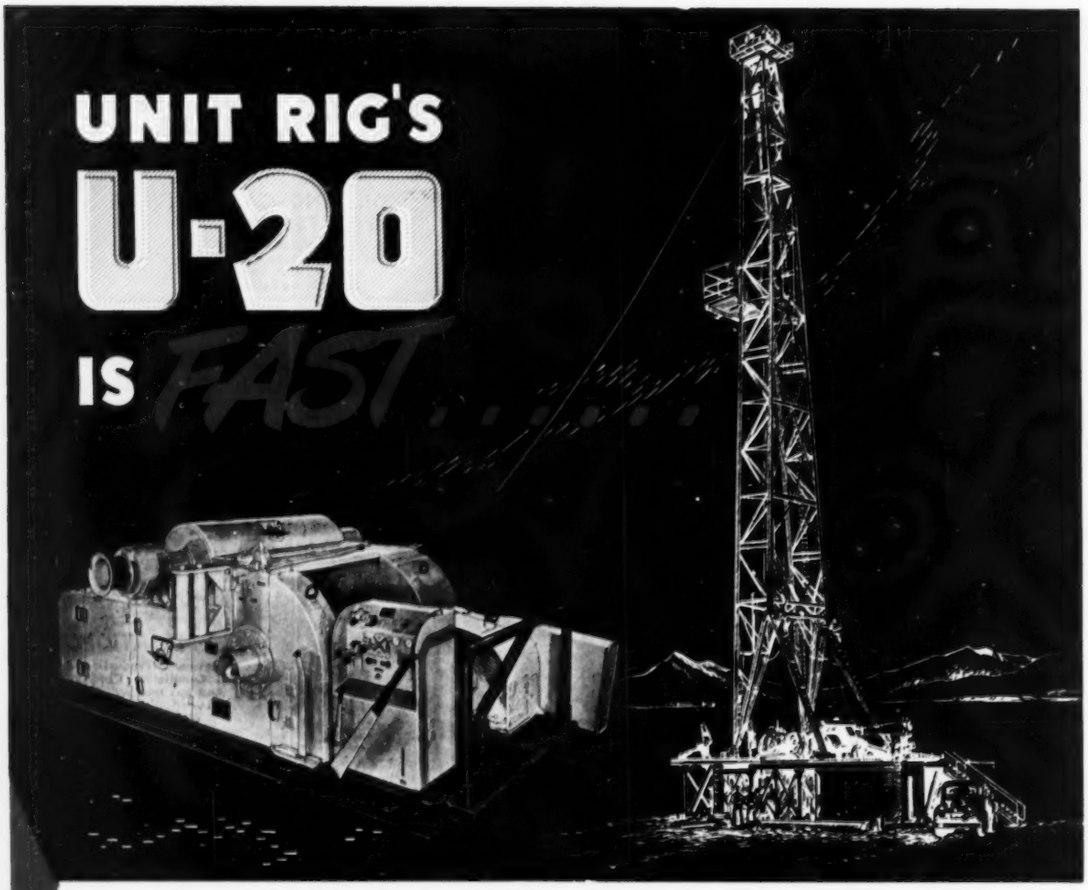

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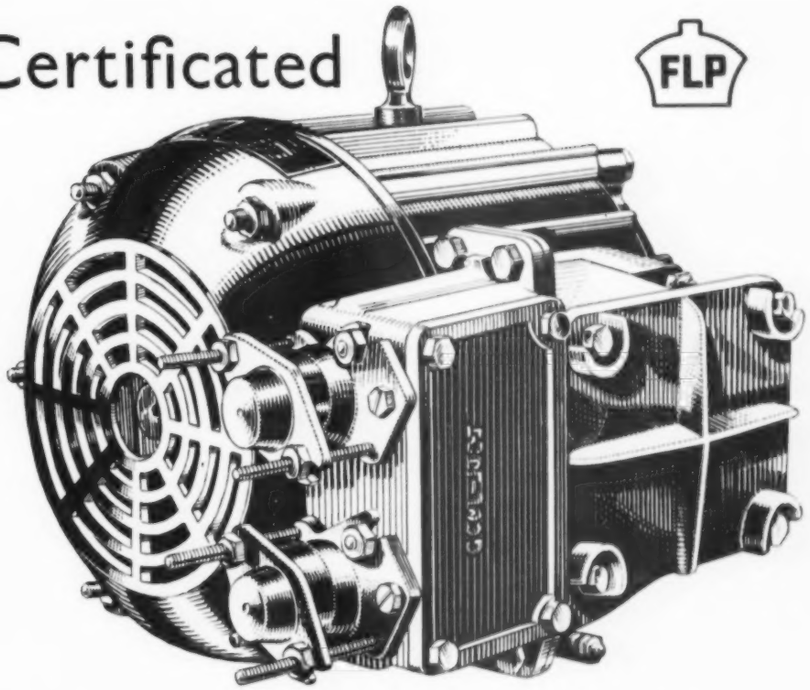

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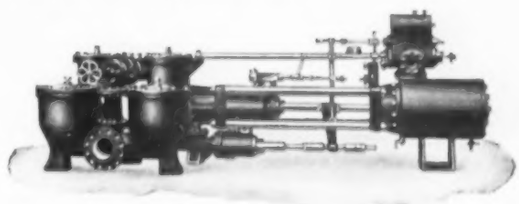

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PETERBOROUGH — ENGLAND

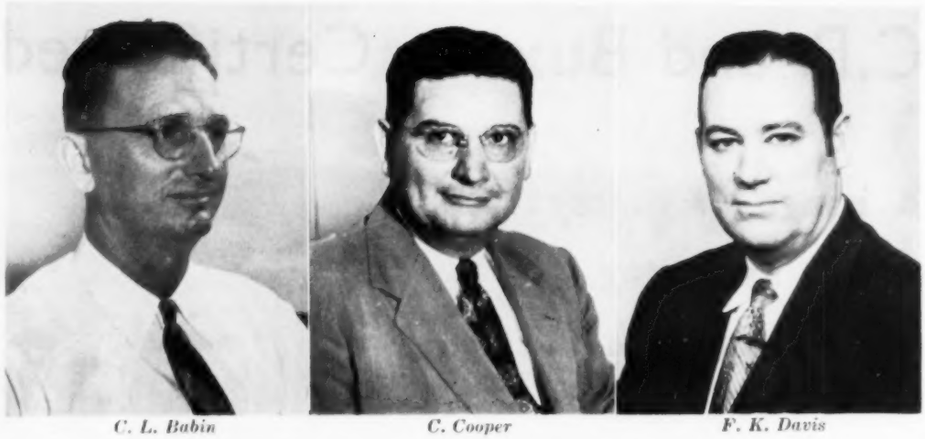
CHESTER L. BABIN, manager of Creole Petroleum Corporation's .refinery in Amuay, Western Venezuela, retired January 1 after 33 years of service in the United States, Colombia and Venezuela. Calvin Cooper, assistant manager of the refinery, succeeded Mr. Babin, and F. K. Davis, operations superintendent in Amuay, was advanced to assistant manager. Montague Ball was transferred from the company's refinery in Caripito, Eastern Venezuela, to replace Mr. Davis.

Mr. Babin began his career in the oil industry as a roustabout for Standard Oil of Louisiana in 1919. He was with Tropical Oil Co. in Colombia for several years and in 1933 transferred to Lago Petroleum Corp. in Venezuela. He worked in both eastern and western fields and was assistant division manager in Maracaibo in February, 1950, when he was transferred to Amuay as refinery manager.

Mr. Cooper worked for eight years in the research and development laboratories of the Standard Oil Development Co. prior to 1943 when he was transferred to Esso Standard Oil (Louisiana division). In 1948 he went to Venezuela as maintenance and construction superintendent of the Amuay refinery. In January, 1949 he was promoted to assistant manager of the refinery.

Mr. Davis joined Humble Oil and Refining Co. at Baytown, Texas in 1926. Subsequently he worked for a number of companies, including Lloyd Refineries Ltd., Port Credit, Ontario, The Lummus Co. and Eastern States Petroleum Co. He joined Creole in 1949 as technical superintendent of the Amuay refinery where he was promoted to operations supervisor in 1950.

Mr. Ball joined Standard Oil in 1923 at the Charleston refinery. He was later transferred to Standard Oil Co. of Ohio's refinery in Lima. In 1945 he was appointed process superintendent at Creole's Caripito refinery, Eastern Venezuela. He was later transferred to the La Salina and Amuay refineries. In 1949 he was promoted to superintendent of refining and terminaling operations of the Amuay refinery. In 1951, he was named as refinery coordinator.



C. L. Babin *C. Cooper* *F. K. Davis*

To Build Crude Unit

Esso Standard Oil Co. has awarded the contract for a 60,000-barrel crude distillation unit at its Bayway, N. J. refinery to The M. W. Kellogg Co., it was announced recently by Russell J. Wolf, vice president in charge of Kellogg sales. The unit will be a three-stage plant similar in design to two now under construction by Kellogg for Esso at its Baton Rouge refinery. Engineering is currently underway with actual erection scheduled to start in early Summer.

To Enlarge Sinclair Refinery

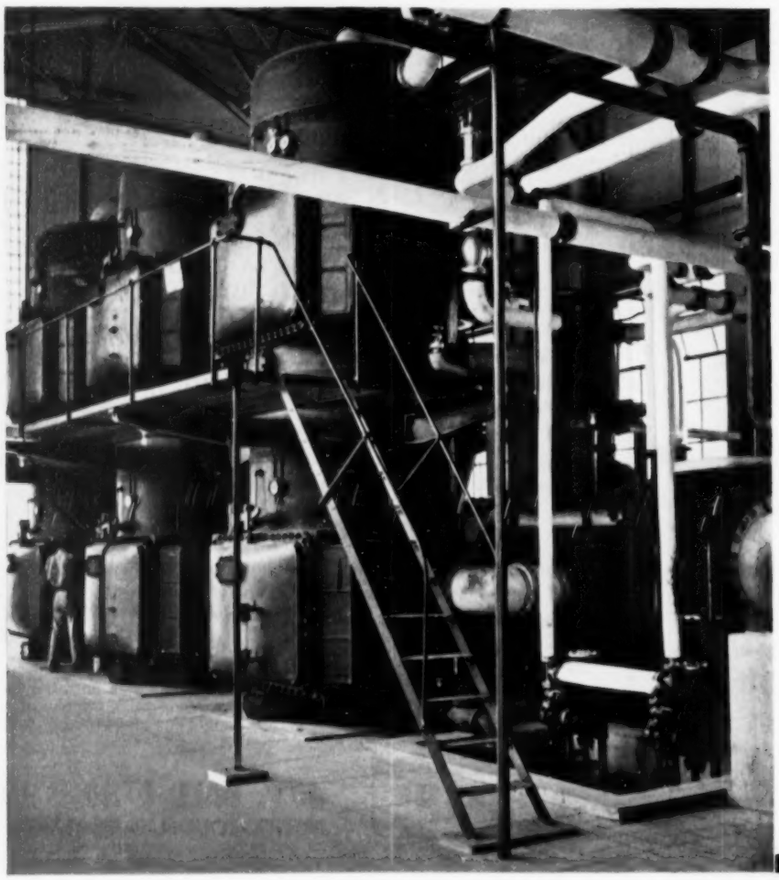
Sinclair Refining Co. will enlarge its Sinclair, Wyoming refinery to permit processing of 6,000 barrels of additional crude per day. Crude and vacuum stills will be revamped and a new air blower added to the fluid cracker which will increase its capacity from 9,000 to 12,000 b/d. It is expected that the new facilities will be completed early in the summer of 1953.

Lister Heads United Geophysical

C. C. Lister has been elected president of the United Geophysical Co. Mr. Herbert Hoover, Jr. continues as chairman and maintains his offices with the company in Pasadena.

R. G. Sohlberg, recently manager of Canadian operations, has moved to Pasadena as vice president of operations. S. O. Patterson, who was formerly assistant manager in Canada, succeeds Mr. Sohlberg as Canadian manager.

After serving in the geophysical department of Mid-Continent Petroleum Corp. at Tulsa, Mr. Lister joined United Geophysical Co. in 1937. The first 10 years of his connection with the company were spent in foreign service. He was a member of United's first party to Trinidad and subsequently worked in Brazil and Colombia. After serving as manager in Venezuela he moved to the Pasadena office and became manager of United's foreign operations. More recently, he has been vice president in charge of operations.



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The illustration shows a Weir Sextuple-effect Evaporating plant to provide 300 tons of fresh water a day from sea water. This is one of twenty-one similar installations to meet the needs of the islands of Curacao and Aruba. At one time water was transported to these islands by tankers, but Weir equipment now supplies sufficient fresh water for all local industrial and domestic demands, and meets the requirements of ships calling at these ports. Fuel for the steam-raising plant comes from the local oil residue.

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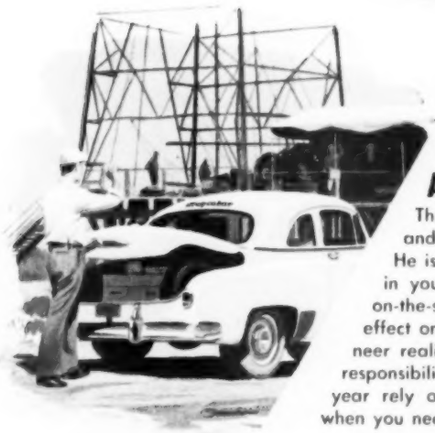

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An Experienced Mud Engineer... Always On Call.

That's the reputation of your Magcobar mud man. But long experience and constant availability are but two of his many important qualifications. He is thoroughly educated in the techniques of drilling from start to finish in your area . . . his background in chemistry and physics supplies his on-the-spot knowledge of drilling fluid ingredients, their properties, and their effect on the formation being drilled. Furthermore, your Magcobar mud engineer realizes his responsibility to the industry he serves and carries out that responsibility carefully and cheerfully. That's why more and more operators every year rely on Magcobar "Mud Doctors." Look for the Magcobar Dealer sign when you need mud.

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Complete
DRILLING MUD SERVICE
DEALER

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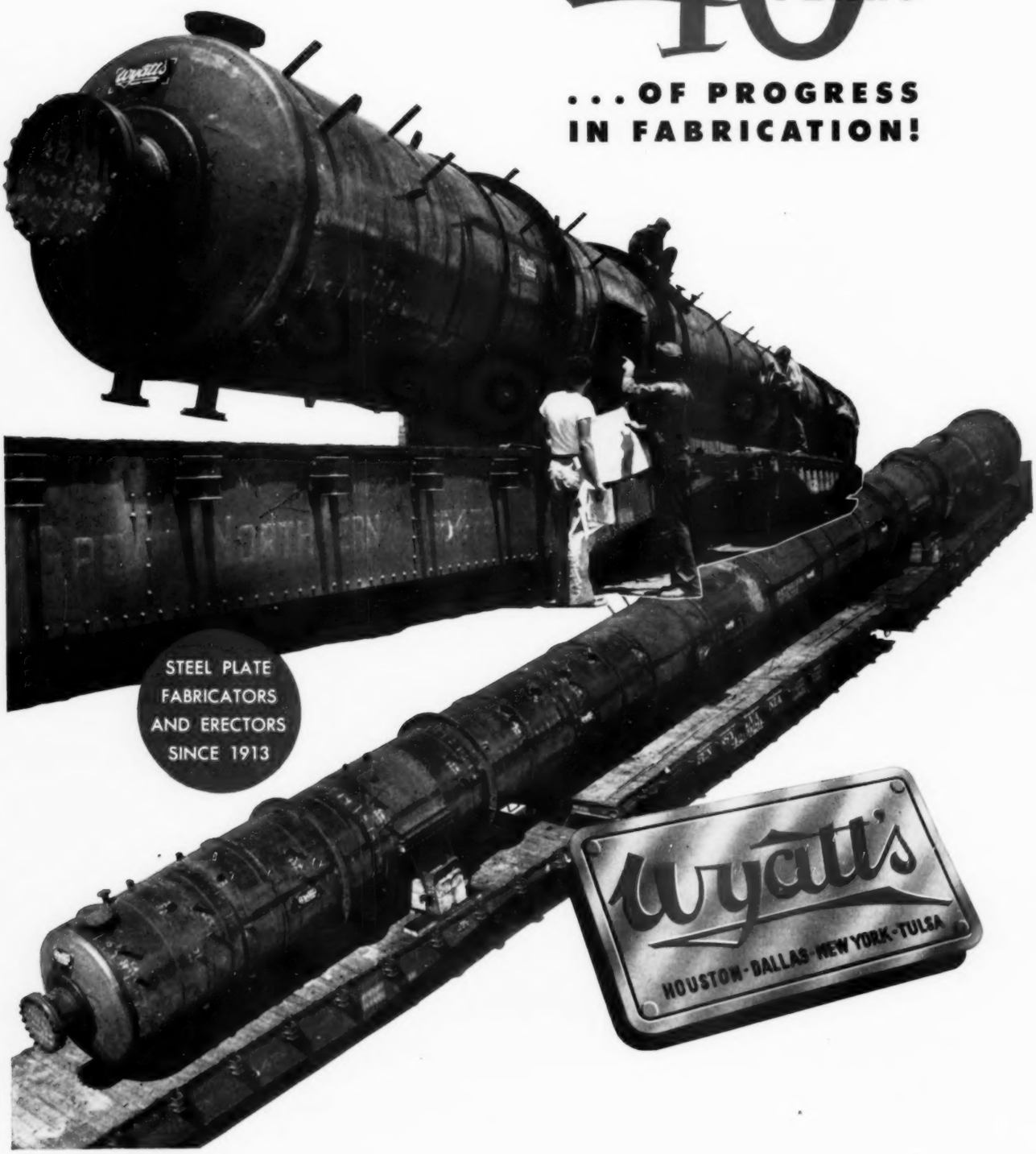
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